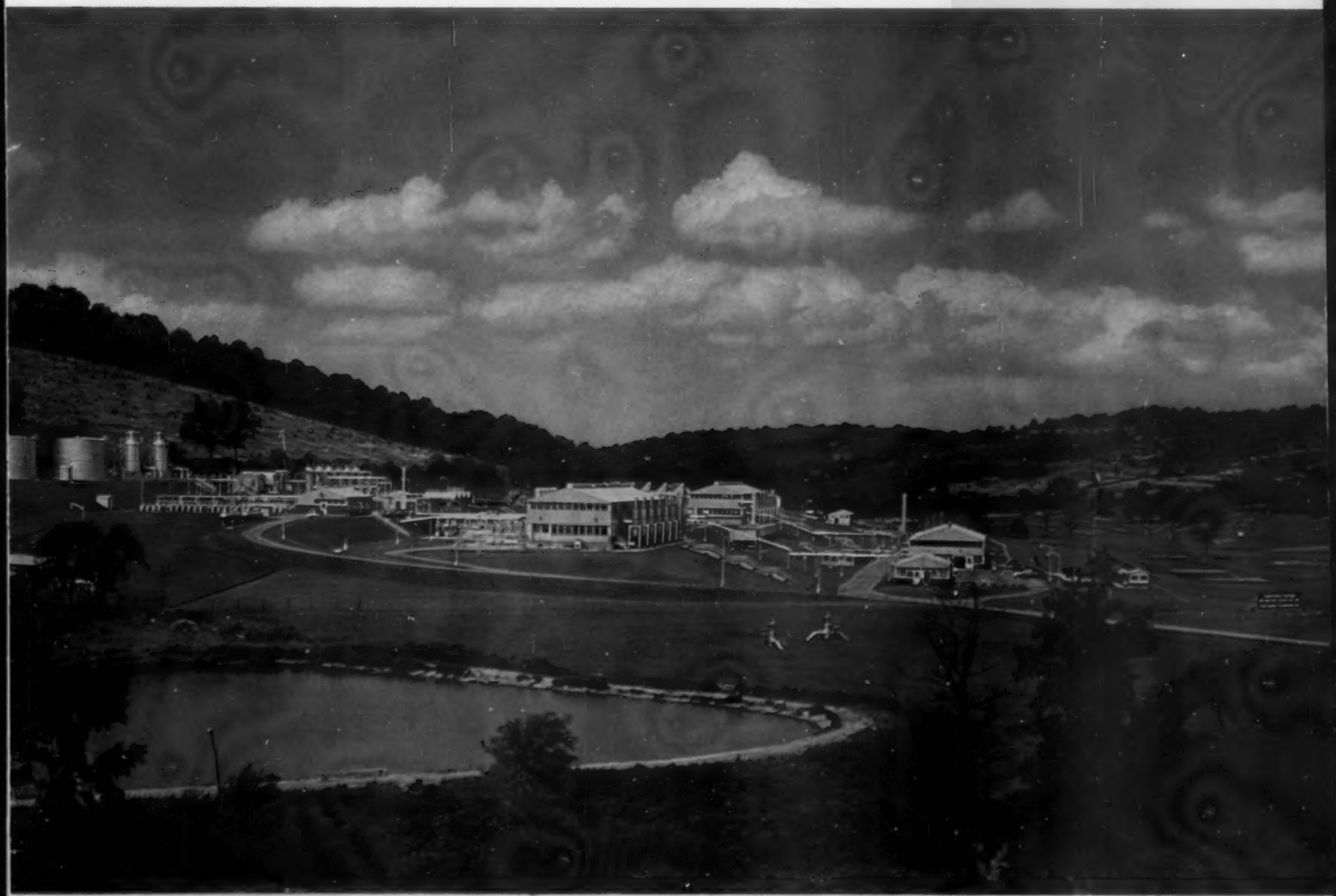
World Petroleum



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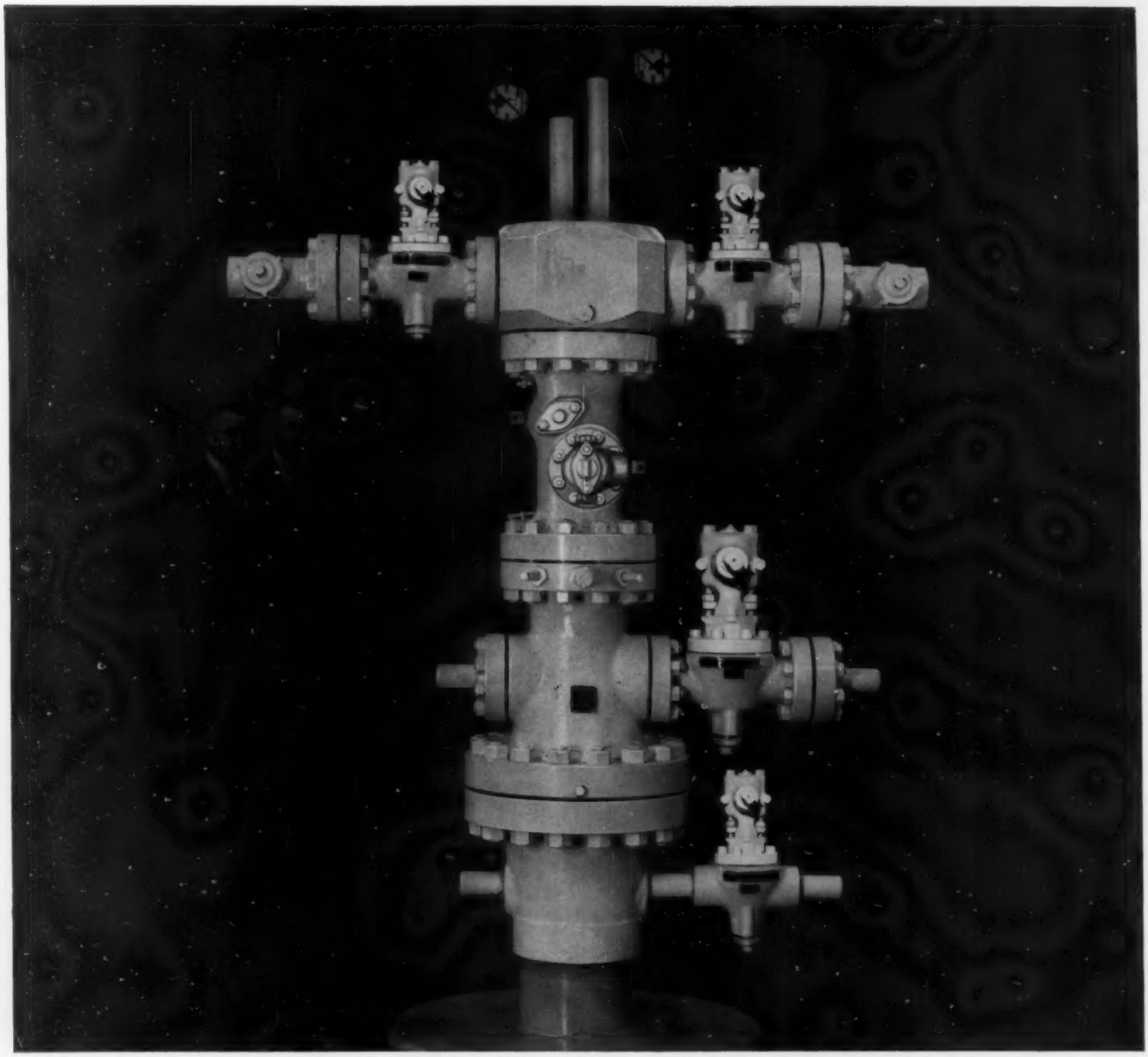

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Cameron, the pioneer in multi-zone completion equipment, has now applied the many dependable features of the Closed-Pressure Method to the remarkable "DC" tree for parallel tubing strings. Suspension is completely versatile, permitting any work on either zone independently. Triple seals are the most advanced in the industry. The unique Cameron Non-Lubricated Master Valve employs the famous Lift-Plug components which may be replaced for a complete overhaul without removal from the tree and, of course, require no lubricants. The "DC" tee and caps permit every known operation to be performed with an absolute minimum of work.

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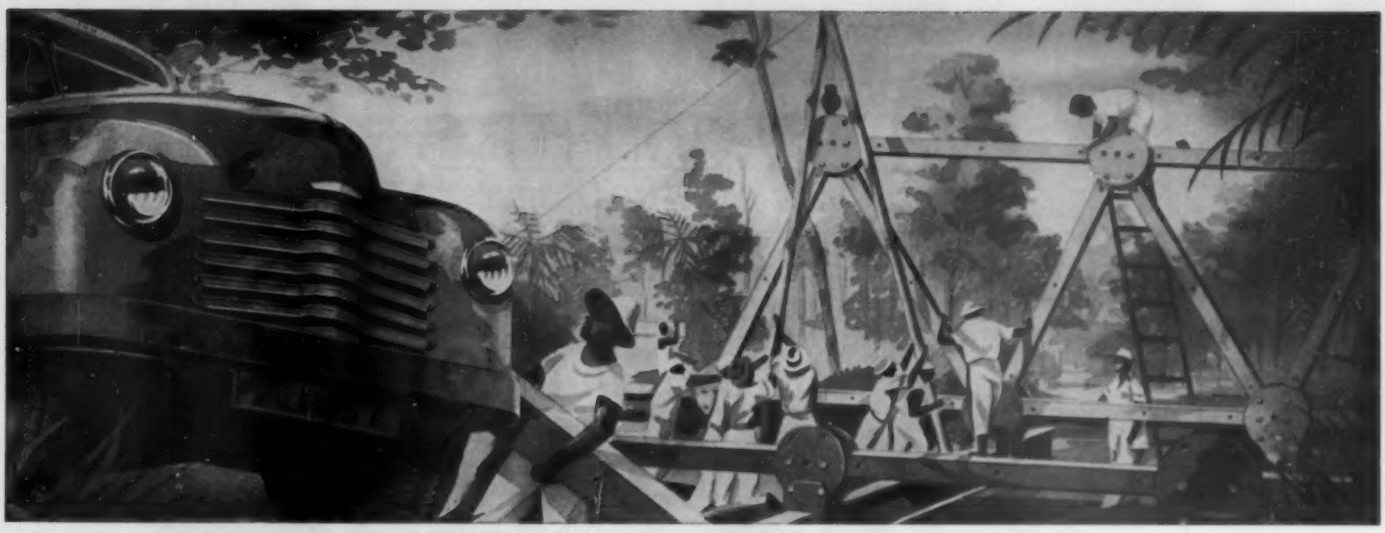

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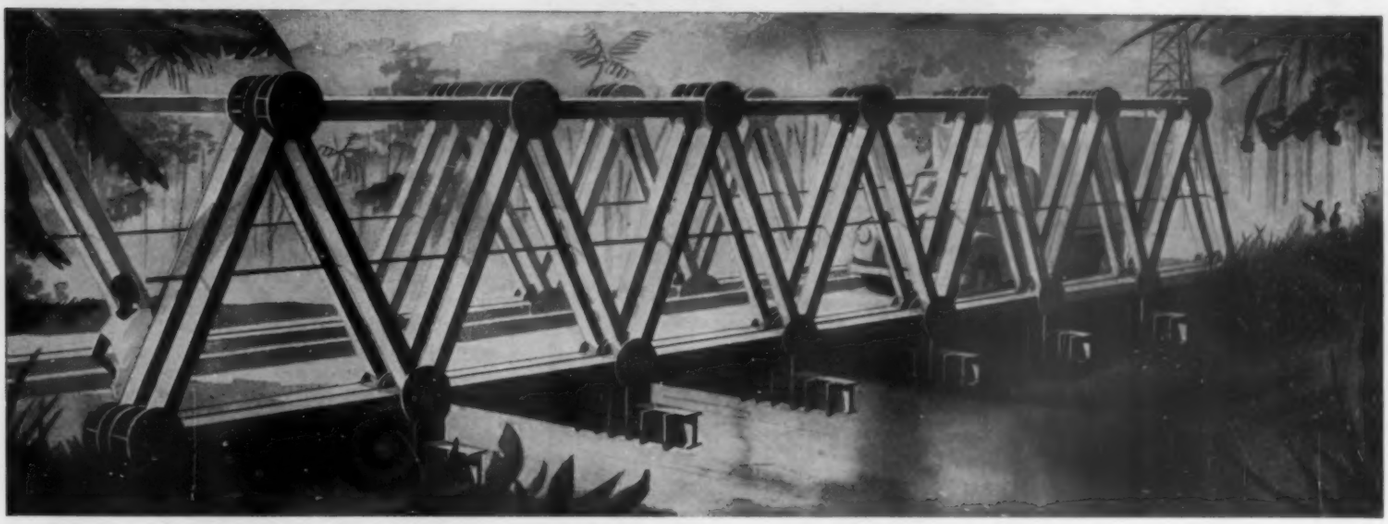

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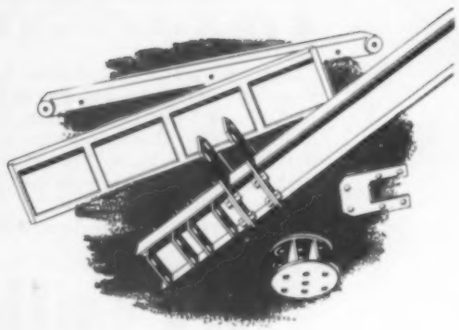

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McCullough Log Finds an Oil Well Where Dry Hole Was Expected

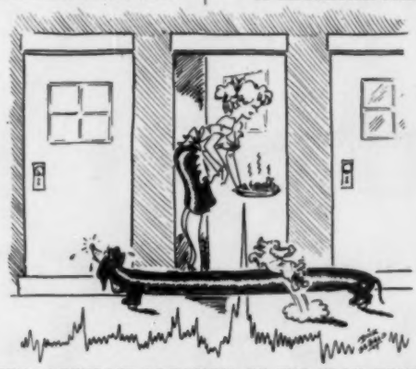
An electric log, run in this semi-wild cat well in Oklahoma, showed a little less than nine feet of possible pay with a small shale break in the center. This was followed by a micro-log which showed very poor permeability in both sections of the sand. From these findings the operator expected a dry hole.

However, a McCullough Radiation Well Log was run, obtaining Gamma Ray and Neutron Curves and recording a simultaneous collar log. The Gamma Ray-Neutron curves accurately located and defined 12 feet of pay sand with two feet of shale in the middle and showed both sections of the sand to be porous.

The well was perforated from logging measurements in a single run by McCullough Super Casing Glass Jets in a Steel Strip Carrier with the two foot shale section blanked off. Thirty-six holes, four per foot, were fired in the two sands.

After perforating, the Steel Strip Carrier was pulled and a bailer was run in the hole. Returns were mud cut oil. Bailer was again run after a 20 minute wait and fluid level had risen 225 feet.

Because of the accurate, reliable information provided by McCullough's Radiation Well Logger, this well proved a valuable extension to an established field.



SPEEDY, ACCURATE LOCATION OF THE "PAY ZONE"!

. . . and in radioactivity well logging, McCullough's short, efficient scintillation counter fully evaluates ALL zones—thick or thin—locates "pay zone" accurately. A longer, less efficient counter may not provide sufficient data to clearly locate and define areas of interest.

Wild Well Killed With Aid of McCullough Radiation Logger

15 Million Cubic Feet Wild Gasser—Burning—Killed After McCullough Gamma Ray-Neutron Log Locates Gas Zone

Accurate, reliable down-hole information provided by McCullough Gamma Ray–Neutron curves located and defined the gas sand responsible for this wild blow-out. The presence of this sand had not been indicated by a previous electric log nor by the drilling log.

The well blew wild on January 16th, burning approximately 15,000,000 cubic feet of gas daily. Numerous attempts, by experts, to kill the well were unsuccessful.

A directional relief well was drilled to 2800′ and cased with 7″ O.D. 23 lb. cemented pipe. Water flood operations were started and about 250,000 barrels of water were injected into the formation suspected of being the cause of the blow-out and fire. Flooding efforts at this depth proved futile. There was no reduction in the volume of gas flow.

McCullough ran a radioactivity log in the relief well and the Gamma Ray and Neutron curves definitely established a substantial gas sand at approximately 2600′, considerably higher than the previously suspected formation. This sand had been completely missed by both electric and drilling logs.

A Bridge Plug was set below the newly discovered sand, cement was dumped on the plug and the zone was perforated by McCullough M-3 Bullet Guns.

Water injection procedure was again started. Five days after the discovery of the new zone, gas flow was reduced to a point where the flame was extinguished and the well brought under control. Another tribute to the efficiency of McCullough's Radiation Well Logger.

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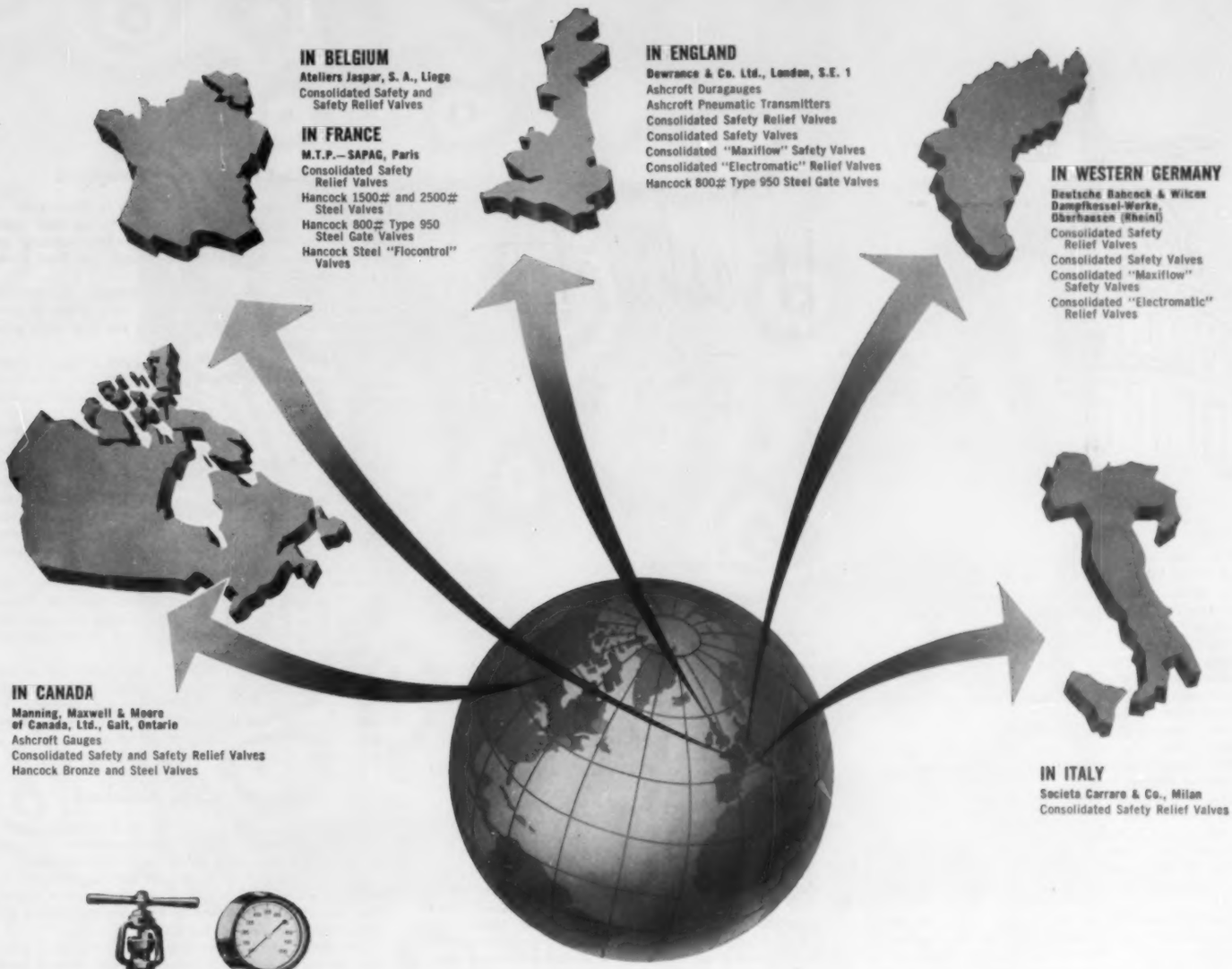

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Washington PIPE LINE

By Joseph B. Huttlinger

The Eisenhower administration is facing a decision today on whether the U. S. Navy can set up new naval petroleum reserves almost at will; or whether the Navy must obtain approval of the U. S. Congress first.

The decision is important; if found to have the authority under existing law, the Navy could claim millions of acres of lands both onshore U. S. and in the offshore lands and take them over as naval oil reserves. A figure of 35 million acres has been mentioned as a starter for the Navy.

Some say the power, if successfully asserted, would amount to the largest grab of oil lands in the history of the country.

The whole matter first came to light last January with a brief item in the budget of President Eisenhower asking $529,000 for the U. S. Navy to explore and drill for crude oil on San Nicholas Island, 70 miles off the coast of California. Later, the Navy said it is seeking a 100 billion barrel oil reserve there.

During hearings on the request, Captain A. S. Miller, director, and Comdr. E. C. Smith, counsel, of the Office of Naval Petroleum Reserves, asserted the Navy's right to drill for oil and hold it as a reserve. They were backed up to the hilt by Under-Secretary of the Navy Thomas Gates.

Chairman Harry R. Sheppard, D., Calif., and other members of the House Appropriations Sub-committee, held a different view. They expressed surprise, and questioned the legal right of the Navy. In the end, the committee denied the fund saying:

"There appears to be no authority or justification for the proposed exploration and drilling on San Nicholas Island."

Chairman Clair Engle, D., Calif., of the House Interior Committee, hauled Navy spokesmen up to his committee to tell their story. After it, he expressed his "astonishment" at the Navy claims. And he dispatched letters to Secretary of the Navy Charles Thomas, and Under-Secretary of the Interior Clarence Davis.

In his letter to the Navy, Chairman Engle wrote that, "The Navy asserts, first, that it has the right and the authority to drill for oil on the San Nicholas Island even though San Nicholas Island is not in one of the established naval petroleum reserves; second, that the Navy has the present authority to drill on any naval reservation regardless of whether or not that naval reservation has been specifically set aside as a Navy petroleum reserve; third that the reservation of public lands for naval uses in effect gives to the Navy a fee title to those public lands; and fourth that the projected withdrawal of Gulf of Mexico Outer Continental Shelf over-water would carry with it authority for the Navy to explore for petroleum in underlying lands.

"As indicated by the record, the members of my committee take vigorous issue with each and all of those conclusions. We believe that the legal conclusions reached are erroneous, specifically with reference to San Nicholas Island and Outer Continental Shelf lands, and in general with reference to all naval reservations. Further, we are unanimously in disagreement with the conclusion that the effect of a reservation of public domain lands for naval purposes gives fee simple title in the public domain to the Navy."

A broad hint that the U. S. Department of Interior disagrees with the Navy, and that it did not know of Navy claims until they saw light in the budget, also is on record. As a result, the Navy and Interior seem to be at odds. If so, the only logical place to settle the matter is at the White House.

Foreign Supply Committee

The U. S. has formally approved a new setup for the Foreign Petroleum Supply Committee, which gathers oil trade statistics for the government. The committee, composed of U. S. oil companies with operations abroad, will have a government chairman, and a government staff.

The new rules were drawn after a suggestion from Attorney General Herbert Brownell, Jr., that there may be anti-trust problems with an industry run committee, as in the past. Approval has been given by the Justice Department and the Federal Trade Commission and the Office of Defense Mobilization.

Thirteen U. S. oil companies have been invited to be members as follows: Arabian American Oil Co., Caltex Oil Products Co., Creole Petroleum Corp., Gulf Oil Corp., Sinclair Oil Corp., Socony Mobil Oil Co., Inc., Getty Oil Co., Standard Oil Co. of Calif., Standard Oil Co. (N. J.), Standard-Vacuum Oil Co., Superior Oil Co., The Texas Co. and Venezuelan Petroleum Co.

"Alky-gas" Again

The "alky-gas" drive has reappeared this political year.

The first farm bill this year, which was vetoed, and the second farm bill contain sections to spur on the use of grain in gasoline.

And other legislation is pending. A bill offered by Senator Karl Mundt, R., S.D., would require that motor fuel contain five percent of alcohol made from grain. A bill offered by Senator Homer E. Capehart, R., Ind., and 34 other Senators, would set up a $100 million administration to study, do pilot plant work and operate commercial plants to make alcohol from grain.

Nothing as drastic as the Mundt bill will become law; but the second farm bill to study the matter and make a report by June 15, 1957 could become law.

What it adds up to is a political campaign for the farm vote; the danger for petroleum is that the campaign could get out of hand, either this year or next. If farmers get the idea the legislators are serious, they may push them to pass a bill later on with teeth in it.

Average Road Speeds

Average speed of motor vehicles in the U. S. is 50.7 miles an hour, according to the Bureau of Public Roads. The rate is 52.1 for passenger autos; 45.8 for trucks; and 52.6 for buses. The figures are as of 1955, and on rural, or non-congested highways.

East Coast Line Dropped

The U. S. has dropped its plans to finance an oil pipe line from the Gulf of Mexico to the East Coast for the reason that additional pipe line capacity has been built, or is in sight, to supply the East Coast in event of war.

Dr. Arthur S. Fleming, director of defense mobilization, gave out the news in a letter to persons who had proposed to build the line with government help.

The latter went to J. W. Hargrove of Texas Eastern Transmission Corp., Shreveport, La., and Paul Ryan, chairman of the board of American Pipeline Corp., New York, N. Y.

Dr. Fleming said the wartime "big inch" pipe line, which was sold for transport of natural gas, could be recaptured by the government in the event of war and used for oil. This would give 335,000 b/d of crude oil capacity from the Gulf to the Ohio-Pittsburgh area. There would be no "serious disturbance" in gas supply to present gas customers, he said, adding the gas could be fed into other systems.

Another 665,000 b/d of crude oil capacity, Dr. Fleming said, has been built into the Ohio-Pittsburgh area by private industry during the past few years. This, he said, adds up to one million barrels daily.

The government, itself, first proposed the added pipe line capacity in a talk by Joseph A. LaFortune, Deputy Petroleum Administrator for Defense, in 1953. The idea was to have pipe line routes to carry one million barrels daily of oil in the event of a war which might shut down tanker routes.

Conservation Attacked

The Interstate Oil Compact, which seeks to regulate the production of crude oil to market demand to prevent waste, may be in for a rigorous study.

The Department of Justice is seeking $681,000 to study whether the compact goes in for price fixing. The department also would spend other funds for travel and the like on the study.

The study stems from action of Congress a year ago asking the department to report once a year on the compact and any price fixing it may bring about.

The sizeable request for funds stunned many in petroleum but Stanley N. Barnes, assistant attorney general in charge of anti-trust, explained an "extensive" study is needed to get the facts for a report.

Whatever the House of Representatives does with the request, it must pass the Senate. Chairman of the Senate Appropriations Sub-committee on funds for the Justice Department is Senator Lyndon Johnson, D., Texas. He is expected to ask questions as to the need for another study of the compact, which is more than 20 years old.

FPC Controls Gas Price

The U. S. Federal Power Commission, still trying to decide how to control the price of natural gas in the field, has taken its first decisions.

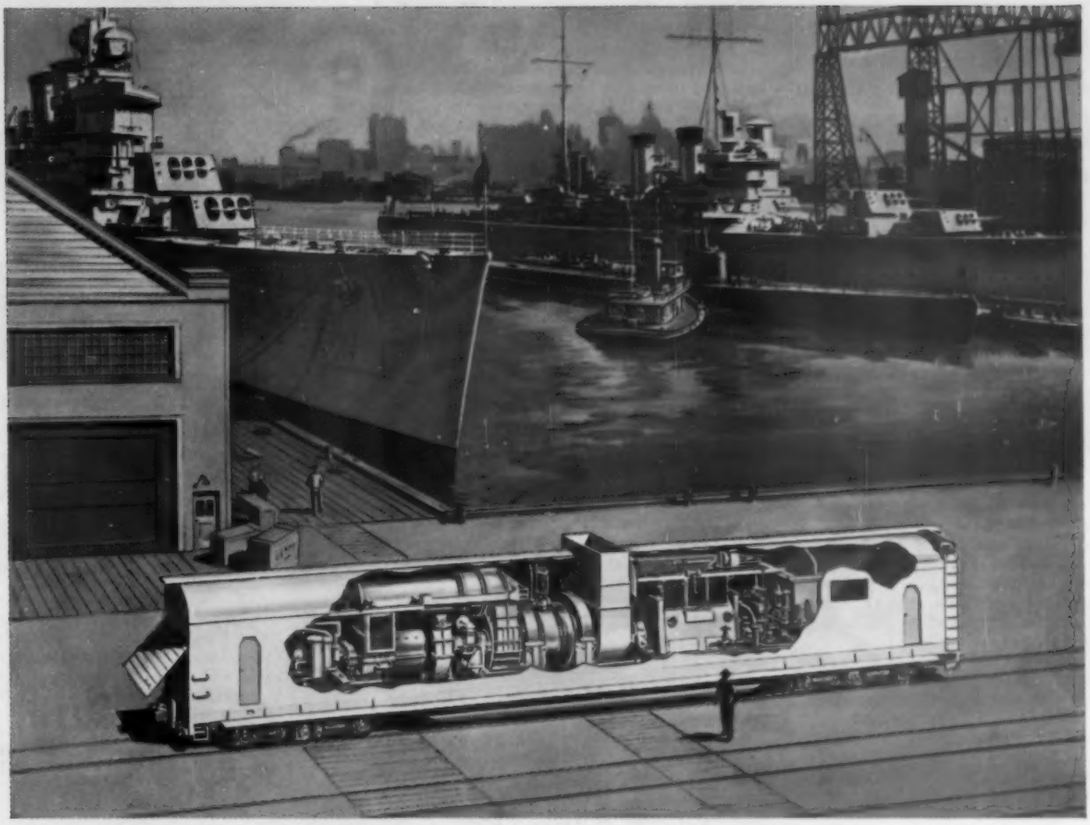
One is to request all gas producers to file with the commission the volume of gas they have been selling. The other is to outlaw, effective July 1, all kinds of favored nation, price index and spiral escalation clauses in contracts.

The actions are outlined in proposed regulations of the commission, and industry is given a chance to object before they become final. Meanwhile, the basic issue goes unsettled, whether the commission shall institute "cost-plus" or other types of controls.

Chances are the commission will not go in for "cost-plus" controls, the worst kind as gas producers see it, even on the basis of a nine percent return on investment.

The latest word from the White House on natural gas has some interesting features for those who follow politics. This word is that the President didn't really want to veto the natural gas bill that reached him this year, but that he had to because of all the fuss of the gift to Senator Francis Case, R., S.D.

Therefore, this word goes, the President will sponsor a new gas bill next year if re-elected.



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Completely self-contained on one railroad car and capable of safe travel at any train speed, this turbo-mobile power plant will deliver 5,500 KW within hours after reaching site where emergency power is needed.

Conceived by the Bureau of Yards and Docks of the United States Navy, such a project had never been faced before and set up staggering problems of design and construction. Original specifications called for a minimum of 4,500 KW, but Clark Bros. Co., beat that by 25%, with additional overload capacity. The completely new type of gas turbine drive can use almost any liquid or gaseous fuel. One man can operate it.

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Canadian Notes

$80 Million Government Loan to Trans-Canada

The Canadian parliament is debating a loan to Trans-Canada Pipe Lines, Ltd. Under the arrangement Trans-Canada puts up the first $7½ million (less anything already spent on the western section) and the government puts up the next $67½ million. The loan is for construction of the line from the Alberta border to Winnipeg, and the government will lend 90% of any further moneys needed up to $80 million.

The $72 million loan is still being debated by the Commons, but its passage seems assured. It may be the final step in clearing Trans-Canada's way for an all-Canada gas line, plans for which have been stopped lately for lack of permission from the Federal Power Commission to permit export of gas from Trans-Canada's line into the United States. The lack of this permission has prevented private financing, since the all-Canada route is uneconomic, at least at present.

The government specified in this latest loan that repayment must be effected in nine months with 5% interest, failing which the assets of Trans-Canada may be seized by the government. Trans-Canada plans to begin construction July 1. The first stage of construction would be that portion from the "Saskatchewan Gate" west 64 miles to Pincher Junction and that portion north from the main trunk line 18 miles west of the gate to Provost 100 miles north, taking in Blindloss, Sibbald and Oyen areas en route. Also the portion 44 miles northwest from Pincher Junction to Sunnynook, taking in Steveville and Cessford.

Trans-Canada Pipe Lines Ltd., has signed contracts for purchase of over 100 mmcf daily of natural gas from The California Standard Co., of Calgary. The gas will come from four Alberta fields—Princess, Nevis, Homeglen-Rimbey and Gilbey.

These contracts nearly complete the major portion of Trans-Canada's gas requirements. Last December the company had signed contracts for more than 80% of its gas requirements.

Canadian Gulf-British American Merge

British American Oil Co. has made an offer to Gulf Oil Corp., to acquire all the outstanding capital stock of Canadian Gulf Oil Co. The consideration for the transaction would be the issue to Gulf Oil of 8,335,-648 common shares of B-A capital stock. These restricted common shares will rank equally with the common shares except that they will be subject to certain restrictions designed to postpone their participation in dividends by the restricted common shares until the earnings of the combined enterprise would be sufficient to warrant the payment of dividends on these shares. Direction of the combined operations would continue in the hands of the B-A board of directors.

New Crude Line In Saskatchewan

South Saskatchewan Pipe Line Co. has applied for a permit to construct a 58 mile, 12-inch main line gathering system, extending from the present facilities in the Cantuar Field south and slightly west to the Dollard Field. This extension will cost approximately $3 million and will extend through the North Premier, Midway, Gull Lake, Bone Creek, and Dollard fields. Upon authorization construction is expected to begin in July of 1956, and to be completed in September.

The South Saskatchewan Pipe Line Co. is jointly owned by the Mobil Oil of Canada, Ltd., Woodley Canadian Oil Co. and Southern Production Co., Inc. This is an addition to the present system which extends from the Cantuar Field to Regina.

Interprovincial Extension Planned

Interprovincial Pipe Line Co. has filed application for permission to extend its crude line from Sarnia to the Toronto area. Plan is to lay 150 miles of 20-inch pipe to connect with the British American Oil Company's plant at Clarkson and the Regent Refining (Canada) Ltd. plant at Port Credit. Both refineries now receive some crude from the Prairies by joint pipe line and lake tanker service.

Both British American and Regent are planning additions to current crude capacity. Regent will add 6,000 barrels to its present throughput capacity of 14,000 b/d. In 1957 British American will complete a new 30,000 b/d crude unit bring plant capacity to 51,500 b/d at that point.

Saskatchewan Gas Line

Saskatchewan Power Corp. is planning a gas line from the Many Island-Lake Hatton gas fields to Moose Jaw and Regina. Deliveries would begin by Oct. 1, 1957 through the 240-mile system. Contracts have been signed for a 20-year supply of gas.

Plan Petrochemical Plant

Canadian Oil Companies, Ltd., will build a second Platformer at its Sarnia refinery to produce petrochemicals. The new $3 million plant will be equipped with a Udex unit for the purification of aromatics. Benzene will be separated for sale to an adjacent chemical plant while toluene and xylenes will be blended with gasoline for octane improvement. The plant is planned for completion in August, 1957. Units are to be designed and engineered by Universal Oil Products Co.

Pembina Completions Up

Pembina oil field was responsible for 57% of all development oil well completions in western Canada in first quarter—237 out of 419. Pembina and the southeastern Saskatchewan fields will be the areas for the bulk of 1956 development completions. Pembina wells accounted for 74% of Alberta's 111 oil well completions in March, setting a growth pace. Total first quarter completions were 15% over 1955.

Activity in British Columbia

Presence of 30 geophysical crews in northeastern British Columbia at end of winter—a new record—is evidence of planning for greatly enlarged wildcatting program, stimulated by export permit to Westcoast Transmission Co., Ltd., which is already laying pipe for its 650-mile natural gas pipe line. More gas and oil discoveries can be looked for in this practically untouched region in 1956.

Alberta Gas Statement

Premier Manning's statement to the Alberta Legislature that the province now has exportable surplus enough for all foreseeable American demand for Canadian natural gas, as well as Canadian needs, is interpreted as urgent concern over stalling of all export pipe line plans. The Alberta government, however, refused to grant export permit to any company until just two years ago. The dominion government contends this reluctance justifies its "Canada first" policy, which is still the dominant element in all political planning of pipe lines.

56 Wells—56 Producers

Sun Oil Co.'s drilling operations in Canada in 1955 produced something of a rarity. After ten years of exploration and drilling dry holes that cost over $4 million, the company sank 56 wells in Canada last year and got 56 producers of oil or gas. Three were exploratory wells that resulted in new discoveries.

The unusual 1955 drilling record raised the company's Canadian reserves of crude oil and natural gas liquids 67%, while production increased 56%, over the previous year.

New Trans-Canada Directors

R. C. Brown, president of Hudson's Bay Oil and Gas Co. Ltd., and E. D. Loughney, vice president of Canadian Gulf Oil Co. have been appointed directors of Trans-Canada Pipe Lines, Ltd.

D. K. Ross

Heads Edmonton Branch

The appointment of D. K. Ross as manager of the Edmonton branch of Seismic Service Supply Ltd., has been announced by the board of directors. Born in Carbon and educated in Calgary, Mr. Ross graduated in electronics in Vancouver. He has been with Seismic Service Supply Ltd., since 1949.

Pine Line Supply House Moves

Canadian Equipment Sales & Service Co. Ltd., Edmonton, Alb., has opened a new office at 38 Racine Road, Rexdale, Toronto. This replaces the office and warehouse which operated for the past three years at 1120 Florence Street, London. A complete stock of equipment for pipe-line construction and maintenance will be kept on hand.

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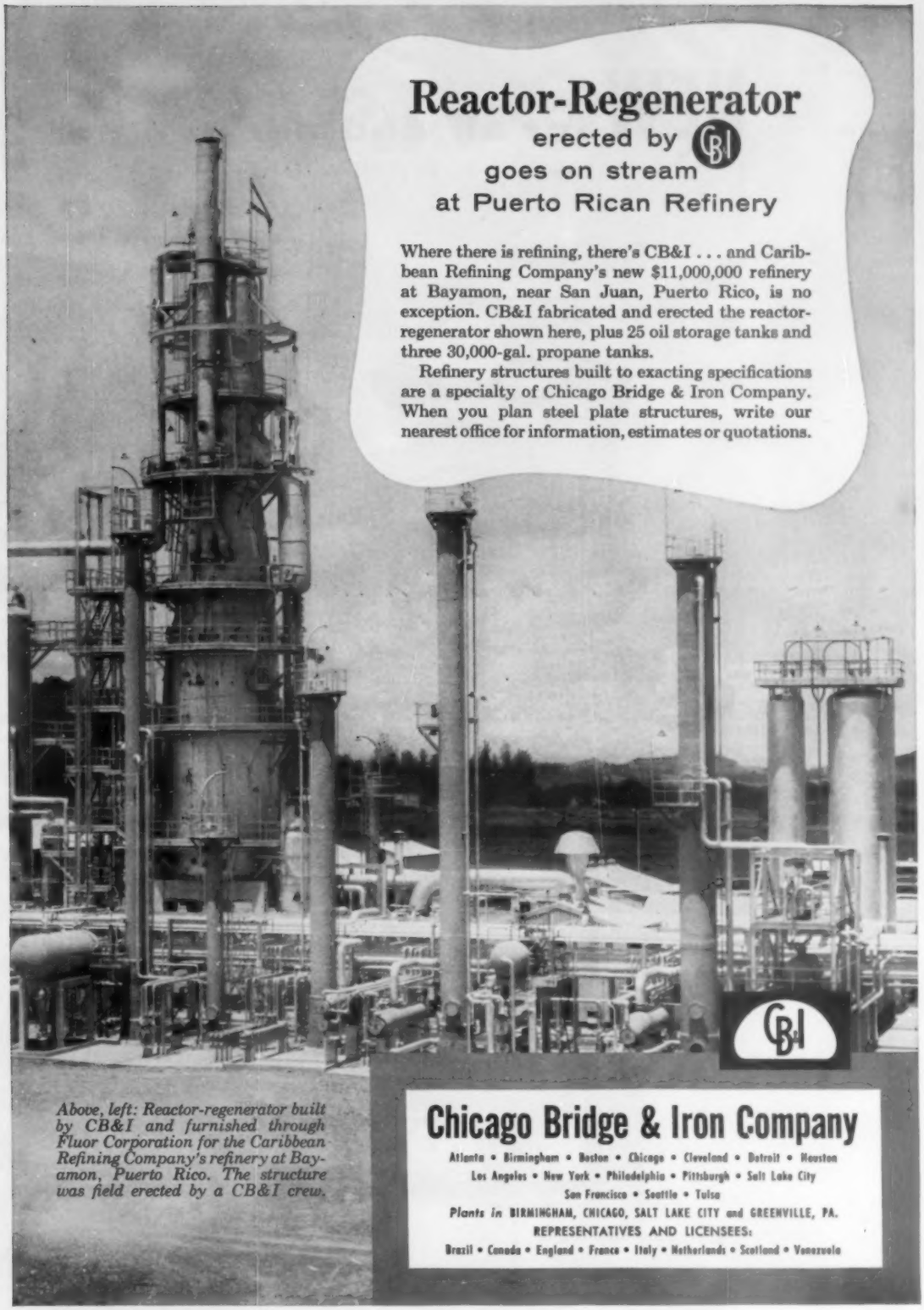

Reactor-Regenerator

erected by CB&I goes on stream at Puerto Rican Refinery

Where there is refining, there's CB&I . . . and Caribbean Refining Company's new $11,000,000 refinery at Bayamon, near San Juan, Puerto Rico, is no exception. CB&I fabricated and erected the reactor-regenerator shown here, plus 25 oil storage tanks and three 30,000-gal. propane tanks.

Refinery structures built to exacting specifications are a specialty of Chicago Bridge & Iron Company. When you plan steel plate structures, write our nearest office for information, estimates or quotations.

Above, left: Reactor-regenerator built by CB&I and furnished through Fluor Corporation for the Caribbean Refining Company's refinery at Bayamon, Puerto Rico. The structure was field erected by a CB&I crew.

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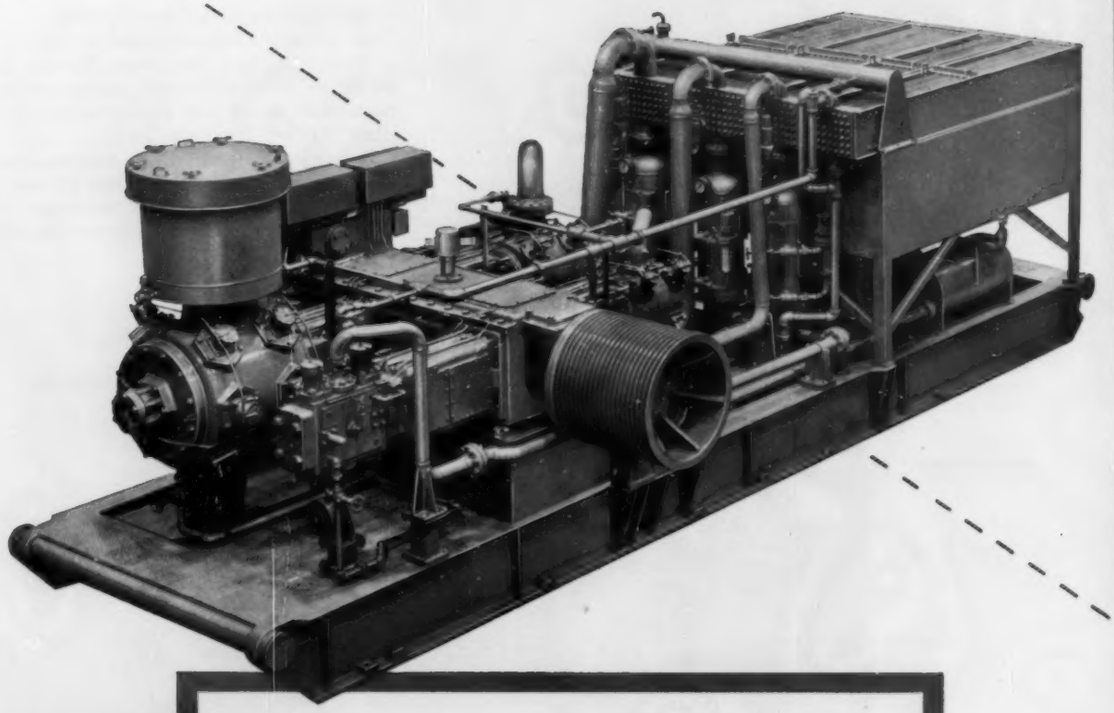

features

so-well balanced—it operates anywhere

so-rugged—it will give years of continuous service

so-narrow and low—it will fit on any road—it's "Highway Width"

so-automatic—it operates unattended

so-economical—your rig furnishes the power

so-easy on engines—load applied or removed gradually—no engine racing or stalling

so-easy to move—it's medium truck size and one trip moves it

so-dependable—a little preventative maintenance keeps it on the job indefinitely

so-well proved—automotive plants have operated similar compressors for years at a time without a shutdown

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PACKAGED AIR COMPRESSOR

A rugged packaged compressor for heavy-duty field service

The new Clark Air-Pac is a completely automatic, 500 horsepower compressor station specifically designed for Air and Aerated Mud Drilling.

With the Clark Air-Pac, the operator is assured of an air supply that is completely dependable and as rugged as the rest of his rig. Work stoppage, which often occurs when light, multiple units are used, is eliminated. The Air-Pac is economical to operate too. In most applications there is ample power available from the rig to drive it. It's also easy on manpower. Being automatic, it operates unattended! And when you move to a new site, it's one unit to move—not a dozen.

The Balanced/Opposed vibration free design of the compressor means you can set the Air-Pac on timbers and forget it.

The Air-Pac uses a special, belt-driven, four stage Clark CMA-4 Balanced/Opposed compressor. The compressor, together with a heavy-duty vertical air flow radiator for intercooling between stages and lube oil cooling, is mounted on a rigid steel skid. Discharge pressure can be set and maintained at any level between 500 and 1,500 psi. Pneumatic controllers regulate both capacity and horsepower *input*—automatically.

If you are contemplating air or gas drilling in any form, your nearest Clark representative will be pleased to supply you with added facts on the new Clark Air-Pac or write Olean.

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Compressors

Eastern Hemisphere Review

AFRICA

Algeria—the United Nations may be called in to determine the exact border location between Algeria and Libya. Interest has been aroused due to Edjele 101, a 400 b/d discovery by CREPS company near the Libyan border.

Libya—Anglo-Saxon Petroleum Co., owned by the Shell Group, has applied for an additional 3,360 sq. mi. concession in southwestern Libya adjoining the recent discovery by CREPS, across the border in Algeria.

Nigeria—Shell has officially opened its new bulk asphalt tankage. This is part of a $2.9 million improvement program at Lagos.

Somalia—Minerara Somalia, the Italian government's company, has started its first exploratory well in the north, about 12 miles from the coast. The parent company, ENI, was recently severely criticized in parliament for spending money abroad when domestic exploration is needed.

FAR EAST AND AUSTRALASIA

Burma—Burma Oil will drill its first post-war wildcat. Location of the well is the Ondwe structure, in Magwe District of upper Burma.

Ceylon—Product imports during 1955 were 17,999 b/d, valued at $27.9 million.

India—The government is insisting on 51% control of any future refineries established. This is an increase over previous requirements, but does not affect refineries already in the country. 78,800 tons (about 551,600 barrels) of gasoline and 123,000 tons of furnace oil (about 861,000 barrels) were exported in 1955 for the first time in Indian history. Indian consumption was 3.75 million tons (about 75,000 b/d) and refining runs 3.45 million tons (about 69,000 b/d) so some products were imported, including lubes and aviation gasoline, but the Burma-Shell and Standard-Vacuum refineries in Bombay recently came on full stream and permitted exports.

Japan—Teikoku Oil Co. has indicated it expects to begin offshore drilling by July with one rig. Three more are planned, to begin by September. Domestic Japanese production is not sufficient to supply internal demand, as indicated by the fact that crude imports during 1955 averaged 146,500 b/d.

Pakistan—Rigs have arrived for Hunt International and Standard-Vacuum companies. The latter plans a wildcat at Jhudo, near the coast of West Pakistan. Hunt plans a wildcat about 80 miles west of Karachi.

Exploration license applications by Shell and Caltex (through Amoseas) companies are being held up pending a depletion allowance.

Philippines—The explanatory well being drilled by Phodco, a local concern, is drilling below 6,200 feet. Strong gas shows and some oil stain are reported. Location of the well is in the Cagayan Valley of northern Luzon Island, about 250 miles from Manila.

Austria—The government has decided to increase oil payments to Russia to 1.3 million tons (about 24,000 b/d) in 1956. This is about 1,855 b/d higher than called for in the 1955 State Treaty and following memoranda which obligated Austria to pay Russia 10 million tons of crude over the coming 10 years for return of the oil fields.

A turbodrill, based on the Russian design, is to be marketed late in 1956 by Mannesmann-Traunzi Co. of Vienna.

Denmark—Jersey Standard is completing negotiations for exploration. The former Gulf Oil concession will be taken over, after an expenditure by Gulf of about $10 million without success. Expiration date of the concession is in 1964, by which date Jersey Standard plans to have spent about $5 million.

France—A new company, Cie. Francaise de Recherches et d'Exploitation de Petrole, has been formed for exploration in France. It is owned by the government through BRP (Bureau de Recherches de Petroles), as well as two State financing companies, FINAREP and COFIREP.

Essorep has received extention of its Landes area permit covering the Parentis field to February 20, 1961. Ci. Francaise des Petroles has obtained two new exploration permits, one for 1.1 million acres in the Seine Maritime, Eure and Somme Departments and the other for 1.2 million acres in the Seine Maritime, Somme, Oise, and Seine-Oise Departments. Both are of four years duration.

Emsco Mfg. has granted manufacturing license rights to Ste. Nationale Marep company, covering all Emsco's machinery, mainly hoists and heavy drilling shafts.

Germany—The West German Esso Company has announced it plans a 100,000 b/d refinery near Cologne for construction by 1961. A pipeline from Rotterdam or Wilhelmshaven to the Ruhr is being studied, for joint construction with other companies.

Germany Socony Mobil's German affiliate is increasing capacity of the Bremen-Oslebshausen refinery 25,000 b/d. A wildcat by Gwerkschaft Brigitta (an affiliate of Shell and SONJ) has discovered about 180 b/d production from a ¼" choke at 5,600'. The well is not connected with the nearby Eilte field, but is located about 2 miles northwest thereof.

Italy—The government has amended the proposed oil law to eliminate the half-mile strip around exploitation concessions. Previous drafts of the law gave this area to ENI, the government's company. The new amendment gives it to any company, or to the highest bidder. Another change lowers the royalty scale to run from 2½% on production under 30 b/d to 22% on production of 1,900 b/d or over.

Spain—Monsanto Oversea S.A. has received an equity interest in production of petrochemical. Etino-Quimica S.A. of Barcelona in return for machinery and technical aid. The plant has facilities for polyvinyl chloride and polystyrene production.

Yugoslavia—Production during the January-October period of 1955 was 214,000 tons (about 5,262 b/d), according to the Yugoslav Special Economic Bulletin. This is about ⅓ of domestic refinery throughput, which averaged 14,116 b/d (a total of 615,066 tons) in the same period.

MIDDLE EAST

Aden—The government of Yemen has protested a British plan to federate the small shaikdoms which comprise the British crown colony of Aden; the government claims they are part of Yemen, which lies immediately north.

Dhofar—Cities Service was drilling below 2,200 feet in early May on Marmul No. 1, their second exploratory well, with no shows so far.

Egypt—A new regulatory government agency for over-all supervision of oil activities is being planned. Anglo-Egyptian is resuming prospecting in the eastern desert under the new petroleum law. Tide Water Associated Oil Company has also presented a concession bid. The company has holdings in Turkey, as well as in the Neutral Zone through ownership in Pacific Western. Other companies applying included those already in the country and two American independents, Ralph Fair, Inc., and Mercel Wagner, both represented through American Eastern Corporation.

Iran—The resources of Iran, including oil, will be surveyed by an American firm. The company is Development and Resources Corporation of New York, headed by David Lilienthal and Gordon Clapp. The survey is part of Iran's development plan to which $375 million in oil revenues will go over the next 7 years.

The 1955-56 budget estimates receipts at 12.1 billion rials and expenditures at 14.8 billion rials, a deficit of 2.7 billion rials ($27 million). The government has requested an increase in oil production to make up this deficit, to which the consortium has agreed in part.

Iraq—Construction of a deep water oil export terminal is being studied by the government at Umm Qasr, 25 miles south of Basrah, near Kuwait. Fao port is too shallow for large tankers. Negotiations with Kuwait to build a port off Kuwait's shore were evidently not completed, although Basrah Petroleum, an IPC affiliate, has received permission from Kuwait to survey a crude pipe line to Mina al Ahmadi terminal of Kuwait.

Payments by Iraq Petroleum Co. and associates to the government of Iraq during the first three months of 1956 were $52,339,980, about 6.1% over the same period in 1955.

Israel—Heletz No. 2, the third discovery well in Israel, has come in at 1,500 b/d, producing from slightly deeper than the original discovery well, Heletz No. 1. A 4 inch pipe line has been constructed to Haifa with about 6,500 b/d capacity, for Heletz production. A third wildcat, Negba No. 1, is drilling on the Huelquat structure in 4½ miles northeast.

Jordan—Terms of the recent exploration concession contract signed with Edwin W. Pauley are as follows: The contract was effective February 2, 1956. Geological work was to begin in two months, with first selection of land for drilling by October 2, 1956. The contract is divided into two areas covering the entire country, with up to one-third to be selected for development. Duration is 55 years, if production is obtained. A pipe line is to be built after discovery either to a refinery built by Pauley or to a port such as Aqaba.

Drilling obligation is 20,000 feet a year in each of the two properties. Exemption is given from all local taxes and customs duties. A cash payment of $50,000 was imposed the first week, followed by $50,000 in each of two following years, rising to $100,000 in the next three years and $200,000 each year thereafter. Royalty is 16⅔%. The 50-50 profits split is called for. U.S. technicians may be used as needed but Jordanians must be used insofar as possible.

Lebanon—The government is resuming negotiations on pipeline transit dues. Talks were halted in January after government demands for payments equal to Syria's, although the distance traversed by pipelines in Lebanon is much less.

The head of the Russian delegation visiting Arab countries has reportedly suggested to the Lebanese Minister of National Economy that the USSR be given a concession for oil and minerals exploration in Lebanon.

Saudi-Arabia—King Saud is reportedly reviving the Ikhwan, a religious force, to combat what is known as a "Free Saudis Movement" bent on overthrowing the monarchy.

Aramco is initiating a water flood operation in Abqaiq's northern end. Injection will be about 150,000 b/d through three wells. The program supplements gas injection begun in 1954 to halt declining pressures.

Syria—Legislation has been passed forcing IPC and Tapline companies to accede to strike demands for 16% wage increase. Work was halted for 11 days but without much effect on operations.

A syndicate headed by Cyrus S. Eaton, chairman of the Chesapeake & Ohio Railroad, is reported to have taken exploration permits on about 1 million acres in the north of Syria. The syndicate is operating through James Menhall, an American drilling contractor from Illinois, who reportedly has 2.07 million acres under lease. Any future profits are to be split equally between Menhall, the syndicate, and the government, according to reports, but the petroleum law calls for 50% of profits to the government.

Bids from eight countries, including the U.S., France, Russia, Britain, Rumania, Yugoslavia, Norway and Czechoslovakia, have been received by the government on the proposed 15,000 b/d refinery at Homs. One, the Czech bid, offered a plant ready to assemble and was accepted "on principle," but must receive approval as being within the specifications laid down by the Egyptian advisors. No decision has been reached yet on Esso's offer to construct a refinery for internal supply at company expense.

Turkey—Two products lines for NATO are constructing in Turkey by Cia. Technica Internazionale of Milan. One 4-inch line will run 205 miles from Bandirma on the Sea of Marmara to Eskisehir in central Turkey. An 8-inch line will run 250 miles from Antalya to Eskisehir.

Yemen—Deilmann Bergbau, a German company, will drill an exploratory well in the Salif district, on the coast north of Hodeida port. Deilmann has a concession obtained in 1953 which covers the entire shore of Yemen, back to the peaks of the mountains paralleling the coast.

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BRAZIL * Cubatao ‡

FRANCE
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JAPAN
Consisting of 4 main islands with a total land area of 142,300 square miles, Japan is a land of mountain ranges, spectacular blossoms—plum, cherry, and peach—and a coastline twice as long as that of the United States.
In Japanese mythology, the nation's history began in 660 B.C., but it was not until the year 1854 that this unique land opened its doors to the West.
Now the West has "discovered" Japan again—providing new markets for diversified products of "The Land of the Rising Sun."

LAND OF THE RISING SUN . . . Despite her enormous losses of manpower and productive capacity in the last war, Japan, restored to full sovereignty in April, 1952, has made a remarkable economic recovery in the short space of 10 years. Today Japan is striving successfully to meet high-level foreign demands for raw materials, textiles, machinery, precision optical goods, chemicals, and specialty food products.

Japan is America's number one customer for many raw materials and basic foodstuffs, while America in turn has become a leading market for Japanese goods. This exotic land of more than 89 million population is today the only Asian country producing and supplying machinery to countries in the East . . . petroleum demand has increased over 60 per cent since prewar days, mainly due to the enlarged scope of Japan's industrial and business activities.

Standard-Vacuum is proud of the part it has played in the economic recovery of this ancient and picturesque country through technological assistance contracts, enabling affiliated Japanese refineries and manufacturers to keep pace with the latest petroleum refining techniques and to utilize a number of processes developed abroad during the past decade.

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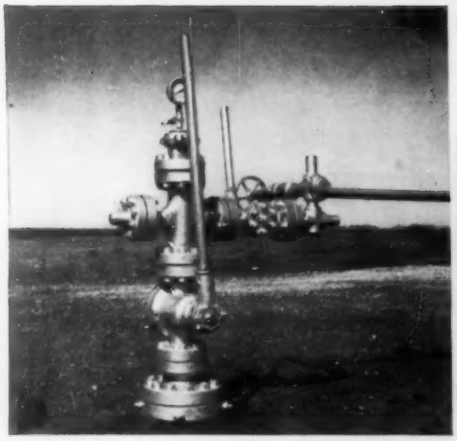
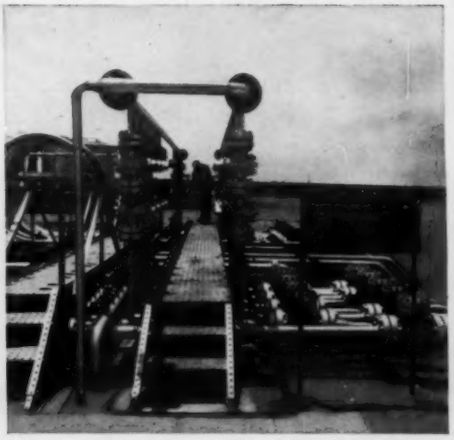
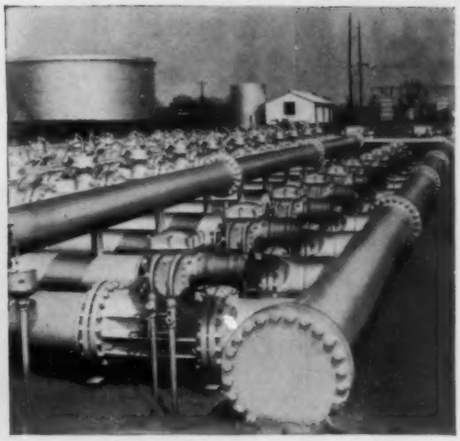
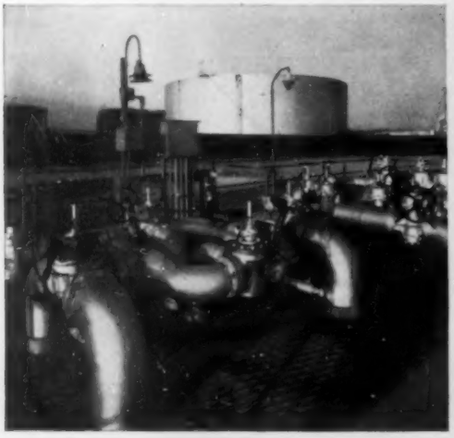
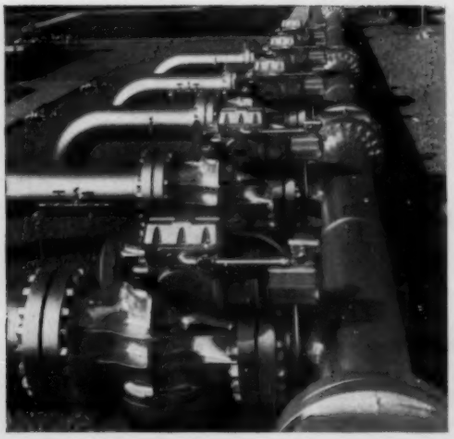
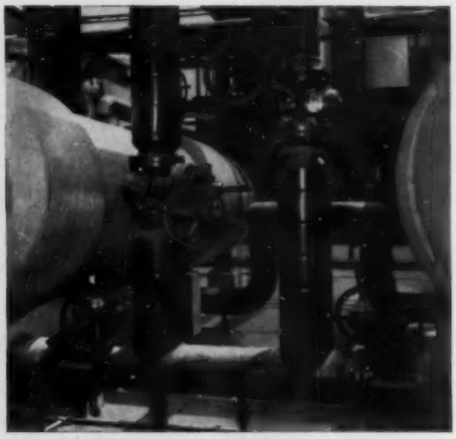




USE NORDSTROM and AUDCO LUBRICATED PLUG VALVES

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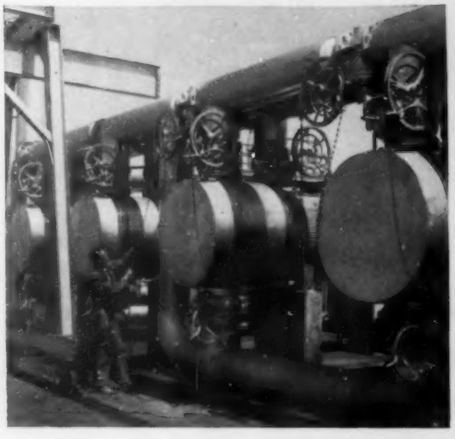
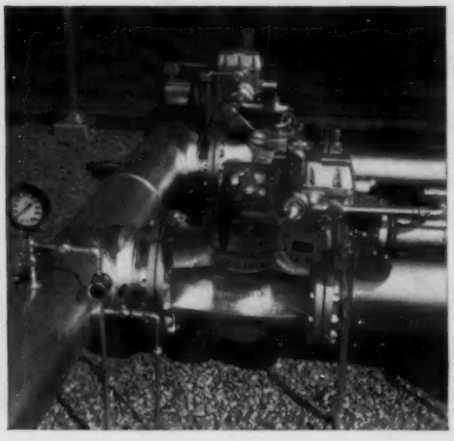
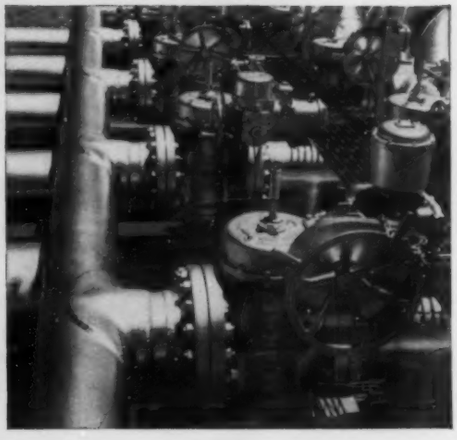

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It's a Rough Business...

Searching for oil in Saudi Arabia is a rough business. ARAMCO oil explorers have to outwit treacherous sand areas where sand dunes 30 to 100 feet high, with no predictable pattern, block the movement of equipment. In the spring, crews are hampered by sand storms and intense heat forbids summer field exploration.

But the search for more and more oil goes on and on in an effort to satisfy the world's constantly increasing demand.

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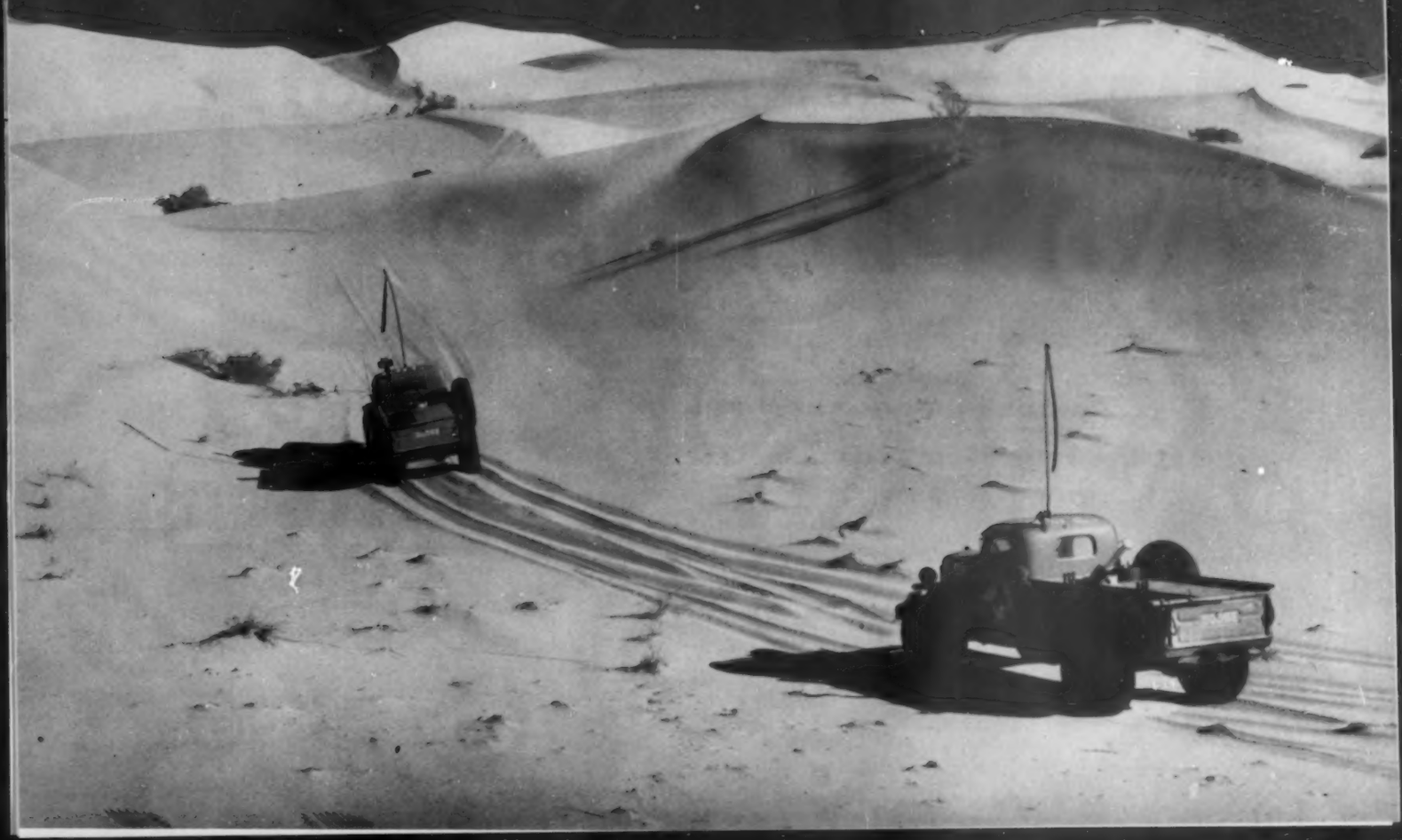

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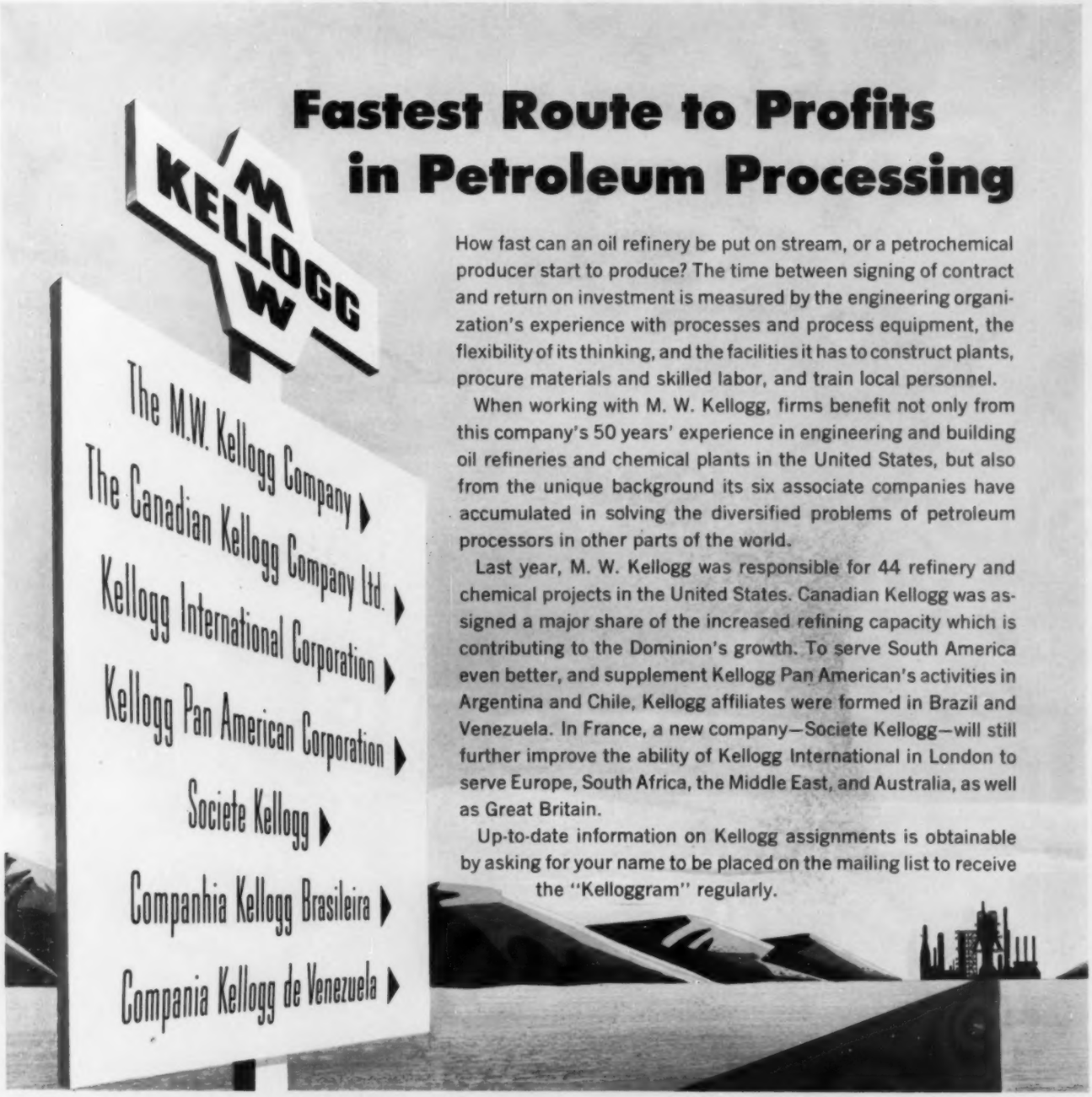

How fast can an oil refinery be put on stream, or a petrochemical producer start to produce? The time between signing of contract and return on investment is measured by the engineering organization's experience with processes and process equipment, the flexibility of its thinking, and the facilities it has to construct plants, procure materials and skilled labor, and train local personnel.

When working with M. W. Kellogg, firms benefit not only from this company's 50 years' experience in engineering and building oil refineries and chemical plants in the United States, but also from the unique background its six associate companies have accumulated in solving the diversified problems of petroleum processors in other parts of the world.

Last year, M. W. Kellogg was responsible for 44 refinery and chemical projects in the United States. Canadian Kellogg was assigned a major share of the increased refining capacity which is contributing to the Dominion's growth. To serve South America even better, and supplement Kellogg Pan American's activities in Argentina and Chile, Kellogg affiliates were formed in Brazil and Venezuela. In France, a new company—Societe Kellogg—will still further improve the ability of Kellogg International in London to serve Europe, South Africa, the Middle East, and Australia, as well as Great Britain.

Up-to-date information on Kellogg assignments is obtainable by asking for your name to be placed on the mailing list to receive the "Kelloggram" regularly.

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DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

June ★ One of a Series of Bulletins for the Petroleum Industry ★ 1956

In This Issue . . .

1. YOU'LL BE INTERESTED in the new dry-dye eduction probe developed by Du Pont. It's described at the right.
2. HOW CAN *YOU* use the Du Pont automotive service discussed below to promote better relations with your large commercial fleet customers?
3. IF YOU HAVE a refinery in the Chicago area, you'll want to know Dr. Neal Lawson and how he can help you make the most efficient use of additives. See next page.
4. THE MOVIE is one of the most valuable of modern sales promotion and training tools. There's an article on the next page about four Du Pont movies produced to help you in your sales, training, and public relations.

They can help you turn complaints into sales

Our Du Pont automotive specialists have more than just faith in the high quality of your fuels and lubricants. They're always prepared to help you *prove* your quality story.

For example . . .

The operator of a fleet of tractors and other gasoline-powered farm equipment, complained about excessive valve burning. He was quite emphatic about blaming the trouble on fuel quality. And he had practically made up his mind to change suppliers when the oil company representative, accompanied by a Du Pont automotive specialist, arrived on the scene to investigate the trouble.

An impartial third party, the Du Pont man was able to convince the rancher that the fuel was not the real source of the trouble . . . but rather that it was the result of tractor operators tinkering with the air-fuel mixture ratio.

This is only one of many cases in which oil companies have been able to turn complaints into good will with the help of a Du Pont automotive specialist.

Our men often accomplish this through the use of the Du Pont fleet of fuel test cars, our single-cylinder demonstration engines and chassis dynamometers – in addition to their own wide experience in solving automotive problems involving the use of fuels and lubricants.

The services of these Du Pont automotive specialists are yours for the asking. And you can get in touch with one of them through any of our sales offices listed in the signature of this ad.

Faster, cleaner, easier gasoline dyeing now possible with new eduction development

A revolutionary new dry-dye eduction probe, developed by Du Pont engineers, can make gasoline dyeing a cleaner, faster and more efficient operation. The device, although simple in design, offers six distinct advantages over other gasoline-dyeing methods . . .

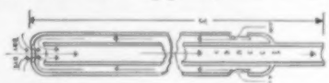
HERE IS a typical setup for using the new Du Pont Dry-Dye Eduction Probe. A short neoprene hose makes possible a permanent, yet completely flexible coupling.

1. "Dusting" is reduced. Exposure of operator and area to dye is minimized. Cleanup time is saved.
2. No plugging of the probe, hence no interruption of the dyeing process. No time loss for clearing plugged probe, and cleanup of area afterward.
3. Dye from the shipping drum can be introduced directly into the finished gasoline. Thus the step of pre-dissolving, required by some systems, is eliminated.
4. Minimum of operating skill required.
5. More pounds of dye are transferred per minute.
6. Minimum investment in space and equipment, considering the cleanliness of operation achieved.

Design and Operation

Conventional probes are little more than pipe sections, some with modified tips. Dipped into the drum, these probes suck up dry dye and pass it into the gasoline system. They are relatively inefficient, however. Extreme care is required of the operator – yet clogging is still likely to occur from time to time. This means interruption of the dyeing process – both to clear the probe and to clean up the area.

In many field tests and under varied conditions, the new probe has been found to be clog-proof, due to its



unique design. It is an aluminum tube within a larger one. The inner tube,

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OVER

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED *Eduction Development*

like the earlier probe itself, transfers the dye from drum to main system. However, the outer tube supplies a down-draft of air, controlled by two adjustable ports at the head end, which insures continuously fluidized flow of dry dye that is uninterrupted by clogging. This feature is an important time-saver.

Dyeing Speed

The new eduction probe makes possible faster dyeing. Tests in units currently in use show speeds ranging from 18 pounds per minute for Du Pont Oil Orange to 40 for Du Pont Oil Red.

The Complete Eduction System

The principal factors responsible for the successful operation of a complete dry-dye eduction system are:

1. Adequate air handling capacity
2. Proper suction-line design
3. The probe described above

A smooth line from the mouth of the probe to the eductor is essential to avoid plugging. The dye probe should be permanently coupled to a short length of neoprene hose. The entire line from the mouth of the probe to the eductor should be of 1-inch inner diameter and completely unobstructed. It should be as short as possible, preferably not over 10 feet. The shut-off valve employed should be of a type permitting full-round flow. Pressure gages guide the operator.

Eduction systems can be used to transfer other fine crystalline materials as well as dry dyes; for example, Du Pont Gasoline Antioxidant No. 29.

However, for the transfer of *liquids* — such as Du Pont Metal Deactivator and Gasoline Antioxidants Nos. 5 and 22 — a separate eduction system should be used. Use of the same system, first for a liquid, then for a dry product, might result in clogging caused by residual liquid in the line.

Low-cost Installation

Your present dyeing facilities can probably be modified to utilize the features of this system at relatively low cost. A Du Pont Petroleum Chemicals Division representative will be glad to study your present system and make appropriate recommendations.

REGIONAL ADDITIVES SALES MANAGER

DR. NEAL D. LAWSON was recently appointed to the newly created post of Additives Sales Manager of the Du Pont Petroleum Chemicals Division's Central Region.

With headquarters in the Chicago office, he is in charge of sales and technical service work for all Du Pont additives other than tetraethyl lead. This includes Du Pont Metal Deactivator, lube and fuel oil additives, antioxidants, dyes, and grease stabilizers.

Prior to this assignment, Dr. Lawson was head of the chemical division of the Du Pont Petroleum Laboratory. He had previously been supervisor of the Laboratory's lube oil group.

Before joining the Du Pont Company in 1947, he was Research Assistant and Instructor in Petroleum Refining at Pennsylvania State University. His work there included research on the oxidation of lube oils, the influence of refining procedures on oxidation, and development of additives for lube oils.

Dr. Lawson is a chemical engineering graduate of Pennsylvania State College, where he also received his M.S. and Ph.D. degrees. He is a member of the American Chemical Society and Society of Automotive Engineers.

These Du Pont movies help promote your on-the-move industry

During recent years, audiences estimated at well over a million people have seen these four Du Pont-sponsored movies promoting your industry.

What Makes a Gasoline Good, a full-color cartoon movie, explains graphically and convincingly how refiners tailor gasoline quality to motorists' needs. Since the film's release, the Du Pont Petroleum Chemicals Division has made available to oil companies a total of 249 prints.

Pipeline on Wheels shows how gasoline tank trucks are made and operated for maximum highway safety. One hundred and seventy-five prints of this film have been made available for oil industry use. For 52 of them which were purchased and distributed directly by oil companies, we have no audience records. But the remainder, distributed by Du Pont on a loan basis, were seen by more than 61,000 people.

A total of 395 prints were made of the Du Pont movie, **It Never Rains Oil,** which tells the story of percentage depletion. Reports indicate that this film is doing an excellent job of creating a better understanding of this important issue.

The newest movie in the series is entitled, **When the Customer says "KNOCK."** It explains — for the benefit of service station operators and customer groups — the many mechanical and atmospheric factors (other than gasoline quality) which contribute to knock.

Prints of these films are readily available to you on a loan or purchase basis. Address your request to any of our sales offices listed below.

DU PONT
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. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.) *Petroleum Chemicals Division* • *Wilmington 98, Delaware*

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S & L steel pipelines, 14 in. and 16 in. outside diameter,

running from the refinery of The British Petroleum Company Limited,

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The pipes and fittings are being butt-welded together (see section below).

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MATTHEW HALL & CO. LIMITED

CHAIRMAN'S STATEMENT

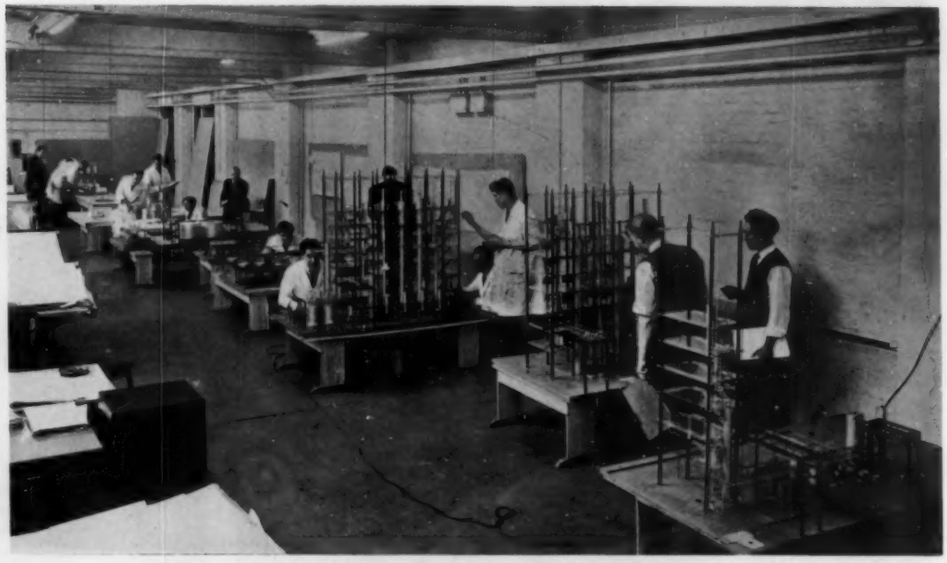
The Twenty-Ninth Annual General Meeting of Matthew Hall & Co. Limited was held on 29th May, 1956, at Matthew Hall House, Dorset Square, London.

The following is an extract from the circulated statement of the Chairman, Mr. Bertram Baden, M.C., S.B.St.J., M.I.H.V.E.:

The Group Net Profit before taxation for the year 1955 was £258,893. (1954 £286,-034.)

£121,100 (1954 £41,000) has been placed to General Reserve and it is recommended that a dividend of 30% (1954 30% on smaller capital) be paid by the parent Company, leaving £217,146 (1954 £225,-279) to be carried forward in the Group's Accounts.

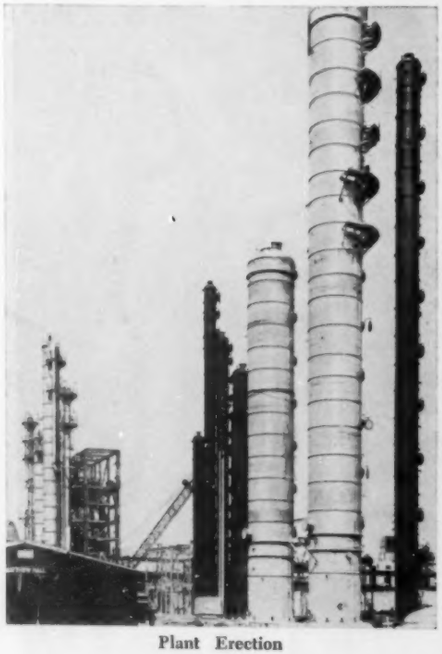
I am happy to tell you that our order book is still satisfactory, but we must not overlook the facts that costs continue to rise and competition is becoming more intense so that we cannot be sure to what extent the favourable conditions we have enjoyed in recent years will continue.



Functional models in one of our design offices

Nuclear Energy

Your Company has carried out engineering work at nearly all atomic research establishments and factories in the United Kingdom. Already we have installed equipment to the value of over £11 million and in addition our contract work has amounted to some £5 million.



Plant Erection

The heavy mechanical work with which we were entrusted for Calder Hall 'A' power station advanced so well that we were subsequently awarded a similar contract in connection with the 'B' power station.

Our work at Harwell, Aldermaston, Capenhurst, Dounreay and Chapelcross continues.

Chemical, Oil Refinery and Industrial Engineering Division

At Grangemouth, in Scotland, we are completing the second stage of a large chemical plant. One of the fractionating columns weighs 85 tons and is 140 ft. high.

For the chemical and oil industries, we are carrying out the design, procurement and construction, including instrumentation, of a variety of plants.

Our drawing offices which were already among the largest in the country, have been further extended.

We have developed new design techniques, incorporating the use of functional scale models.

Matthew Hall (Pty.) Ltd.

The Chemical Division has installed equipment and services for a metallurgical research laboratory, chemical lead-burning for nitric acid plants, the design, fabrication and installation of process equipment for the manufacture of synthetic enamels and paints, and the supply and erection of water demineralisation plants.

Our factories at Wadeville, Welkom, Cape Town and Durban are kept occupied and have fabricated pipework up to 30 in. diameter.

Federation of Central Africa

Our second branch and factory—at Salisbury—was opened during the year.

Contracts include engineering work at the copper mines.

The above brief resume shows the wide variety of your Group's activities.

A pension and life assurance scheme has been introduced for office staff in the United Kingdom and similar schemes are being considered for our Rhodesian branches and South African Company.

I would like to express the sincere thanks of the Board to all employees at home and overseas for their loyal and efficient services during the year.

The report and accounts were adopted.

A GOOD DOSE OF INSPIRATION NEVER HURT A CONSTRUCTION PROJECT

The quality of inspiration is of vital importance to the builder. Here at PROCON our men are well imbued with it. But, to this creative sense, we add those essential qualities of broad experience and sound technical knowledge so necessary for the satisfactory completion of any project, on time, and to every specification.

It is this combination of skills that makes us confident PROCON can provide to the fullest measure, reliable, efficient service in the planning, engineering and construction of your refinery, petrochemical or chemical plant. We are proving this, the world around, day after day.

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CLARK BROS. CO., Olean, New York—Gas turbines, engines, and reciprocating, centrifugal and axial flow compressors — gas, steam, electric and diesel driven.

DRESSER IDECO

DRESSER-IDECO COMPANY, Columbus, Ohio — Radio and television broadcasting towers, steel buildings, aircraft hangars, mechanical parking garages, electric power substations.

DRESSER MANUFACTURING DIVISION

DRESSER MANUFACTURING DIVISION, Bradford, Pa. — Pipe line couplings, pipe repair sleeves and clamps, weldments, forgings, welding fittings, flanges, rings.

IDECO

IDECO, Dallas, Tex.—Hydrair* and Power Rigs; Full-View* Masts; Substructures; Single, Dual and Drive-In Rambler Rigs; Blocks, Swivels, Rotaries; Mud Pumps; Petroleum Equipment and Supplies.

Magcobar

MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar* and Magcogel* drilling muds and other specialized oil well drilling fluids and chemicals.

PACIFIC

PACIFIC PUMPS, INC., Huntington Park, Calif. — Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.

ROOTS-CONNERSVILLE

ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind.— Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, vacuum pumps, inert gas generators, and positive displacement meters.

Security

SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif. — Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Red rubber stabilizers.

electronic eyes and ears for industry

SIE

SIE — world's largest manufacturer of exploration seismograph equipment — serves as headquarters laboratory for the petroleum industry's geophysical organizations. Hundreds of SIE seismic systems are used by major oil companies and geophysical contractors to seek oil-bearing underground strata — a world-wide record of acceptance unmatched by any other company.

Southwestern Industrial Electronics has developed highly advanced electronic and electro-mechanical instrumentation for industrial automation, electronic computing instruments for measuring fluid and gas flow, data reduction equipment, and a wide range of electronic laboratory testing and recording instruments. Many SIE developments in electronics and automation are widely used in production and processing applications in many industries.

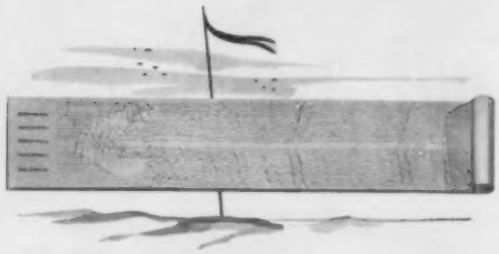
LANE WELLS

LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot* perforating and bullet perforating, packers and bridging plugs.

SIE

SOUTHWESTERN INDUSTRIAL ELECTRONICS, Houston, Tex.—Seismograph systems and instruments—electronic, electro-mechanical. Computers—analog and digital; recording systems. Special transformers, reactors.

* Trademark registered



again-

another dimension to the DRESSER *plus+*

SIE The newest addition to the Dresser *plus+* family of independent – and integrated – companies is SIE . . . Southwestern Industrial Electronics. The many SIE seismic systems in operation today have made significant contributions to the petroleum industry's remarkable record of finding new reserves of oil and gas. Coupled with this, SIE's recent developments in the new field of automation provide an equally important contribution to industry in general.

As geophysical activity has increased and become more effective, SIE has paced the industry by developing new equipment and methods. Today SIE seismic systems, magnetic recording systems, geophones, recording oscillographs, precision galvanometers, radios and other electronic instruments are serving the oil industry in every major field in the world. SIE adds electronic instrumentation to the broad application of Dresser *plus+* equipment and services.

The unique teamwork offered by Dresser companies covers every phase of the oil, gas, chemical and electronic industries . . . and combines to make the Dresser *plus+* a symbol of superior products and services that are the standard of comparison throughout the world.

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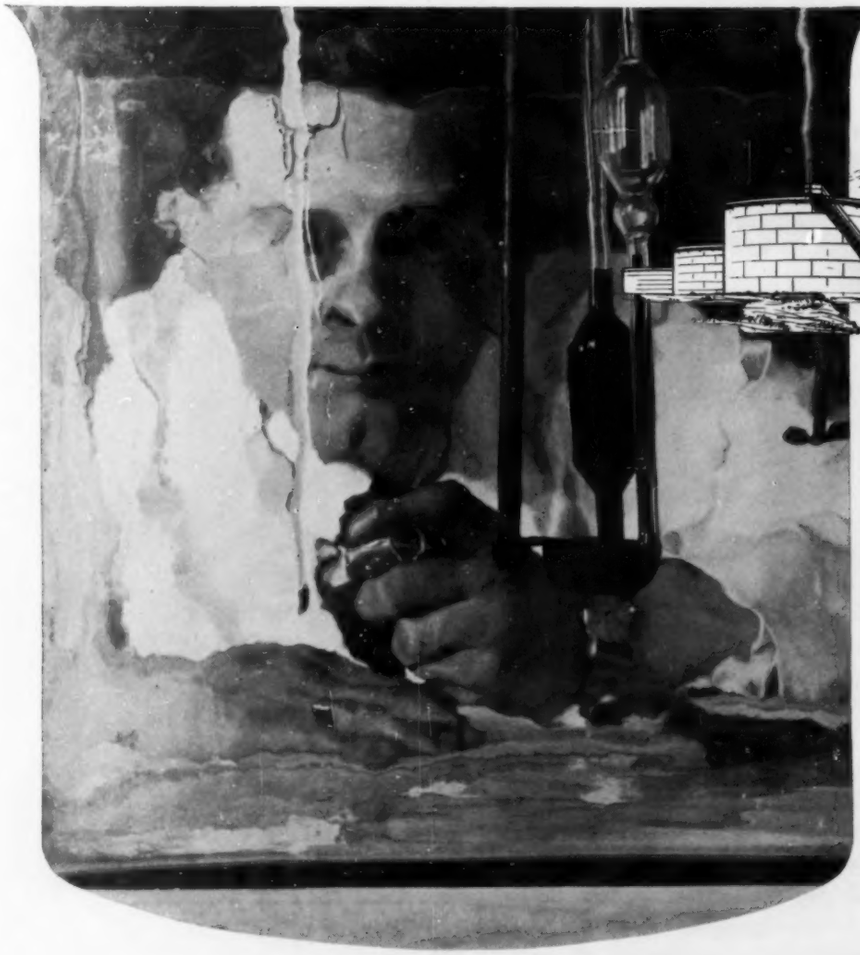
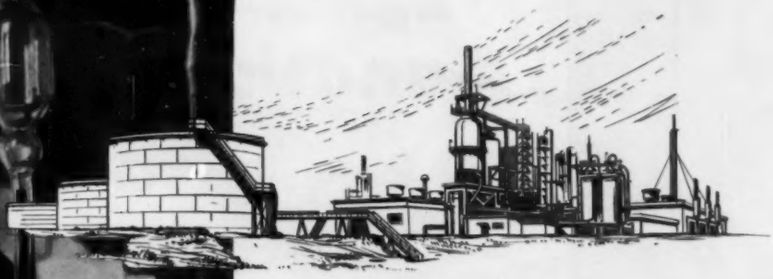
SUPPLIERS OF FIRE EXTINGUISHERS
THE PYRENE COMPANY LIMITED

He's putting out a fire *before it happens!*





In the world's largest refineries, in tank farms and dock installations, in every branch of the Oil industry, 'Pyrene' Fire Fighting Equipment utilising Foam and every other tried and proved medium safeguards property, stock, plant and even human life from the ravages of fire.

Seen distorted through the water bath which maintains the critical temperature of his apparatus, a physicist of The Pyrene Company checks the viscosity of a batch sample of 'Pyrene' Foam Compound exactly to specification. Routine checks of this nature, rigorously carried out in the Pyrene laboratories on *every* batch of 'Pyrene' Foam Compound that is made, ensure its consistent high quality—make certain that whenever and wherever it is brought into action 'Pyrene' Foam Compound will quell fire instantly, with the free-flowing yet tenacious characteristics for which it is justly famous throughout the world. If you would like us to keep you informed of the latest developments in 'Pyrene' Foam Compound and equipment write to Dept. W.P.6 THE PYRENE COMPANY LIMITED 9 Grosvenor Gardens, London, S.W.1., England. *Phone:* VICTORIA 3401 *Cables:* 'PYRENE · LONDON'

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Pyrene TRADE MARK
foam
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produced by the world's leading makers of foam equipment

SINCLAIR and PARSONS TEAMWORK

Beats Tight Schedule On Hydrodesulfurization Job!

8 Months From Outset To Output!

Sinclair was in a hurry for completion of its 10,000 BPSD Hydrodesulfurizer at its Marcus Hook Refinery—time meant money and there was none to waste.

A contract was awarded to Parsons for design, procurement, and construction of the plant.

Sinclair's engineers, Purchasing Department, and field staff meshed their activities perfectly with those of Parsons. **Eight months later** the plant was in operation upgrading the quality of Sinclair Super Flame Heating Oil.

THE RALPH M. PARSONS COMPANY

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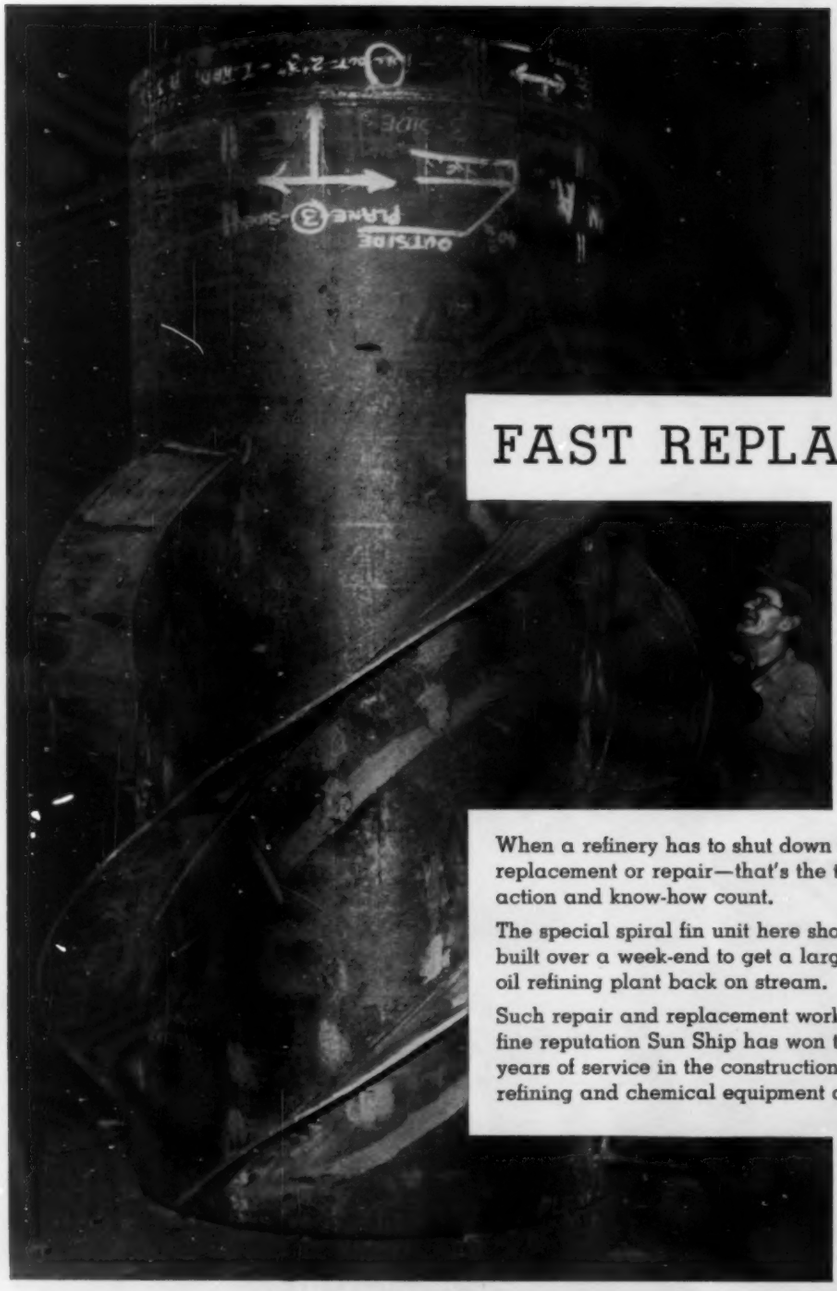

FAST REPLACEMENT

When a refinery has to shut down for a replacement or repair—that's the time when action and know-how count.

The special spiral fin unit here shown had to be built over a week-end to get a large oil refining plant back on stream.

Such repair and replacement work has added to the fine reputation Sun Ship has won through years of service in the construction of oil refining and chemical equipment of every kind.

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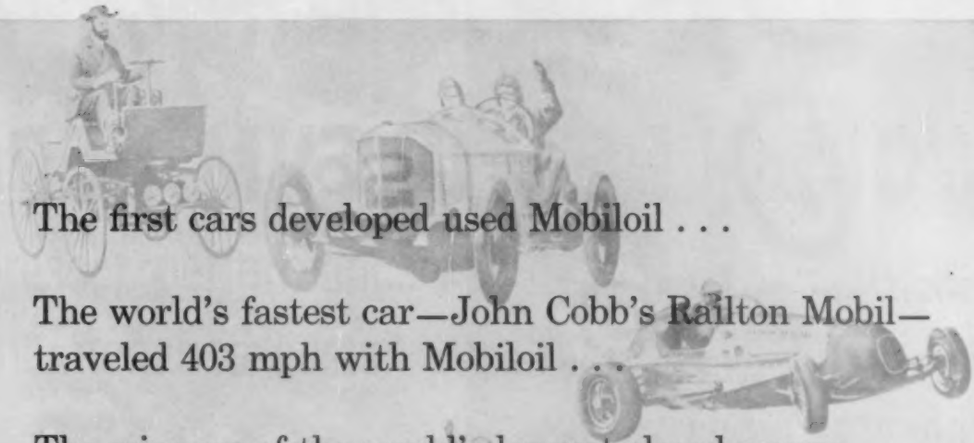
It's no Coincidence...



The first cars developed used Mobiloil . . .

The world's fastest car—John Cobb's Railton Mobil—traveled 403 mph with Mobiloil . . .

The winners of the world's longest closed course race—the Indianapolis 500—for the last five years in a row used Mobiloil . . .

The winners, for year after year, of the world's steepest uphill race, the Pike's Peak Hill Climb . . . the world's longest, toughest road race—the 1900-mile Pan American Race . . . the holders of major stock car records coast-to-coast—all used Mobiloil . . .

Yes, it's no coincidence, today more automobiles in the United States and throughout the world use Mobiloil than any other brand.

Mobil Pays Off—in Progress, Performance and Protection

SOCONY MOBIL OIL COMPANY, INC.

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consisting of legal and economic studies of the PETROLEUM INDUSTRY in most countries of the world

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(2) Petroleum laws governing exploration and development, with analysis thereof and latest amendments; including terms of concessions previously granted.

(3) All other factors affecting the security and desirability of petroleum investment, including taxation, exchange control as regards petroleum, labor situation, wage rates, political stability and investment history, attitude toward foreign capital and investors, etc.

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1	$200
3	150
5	125
10	100
40 or more	75

(cost includes correction supplements for 12 months)

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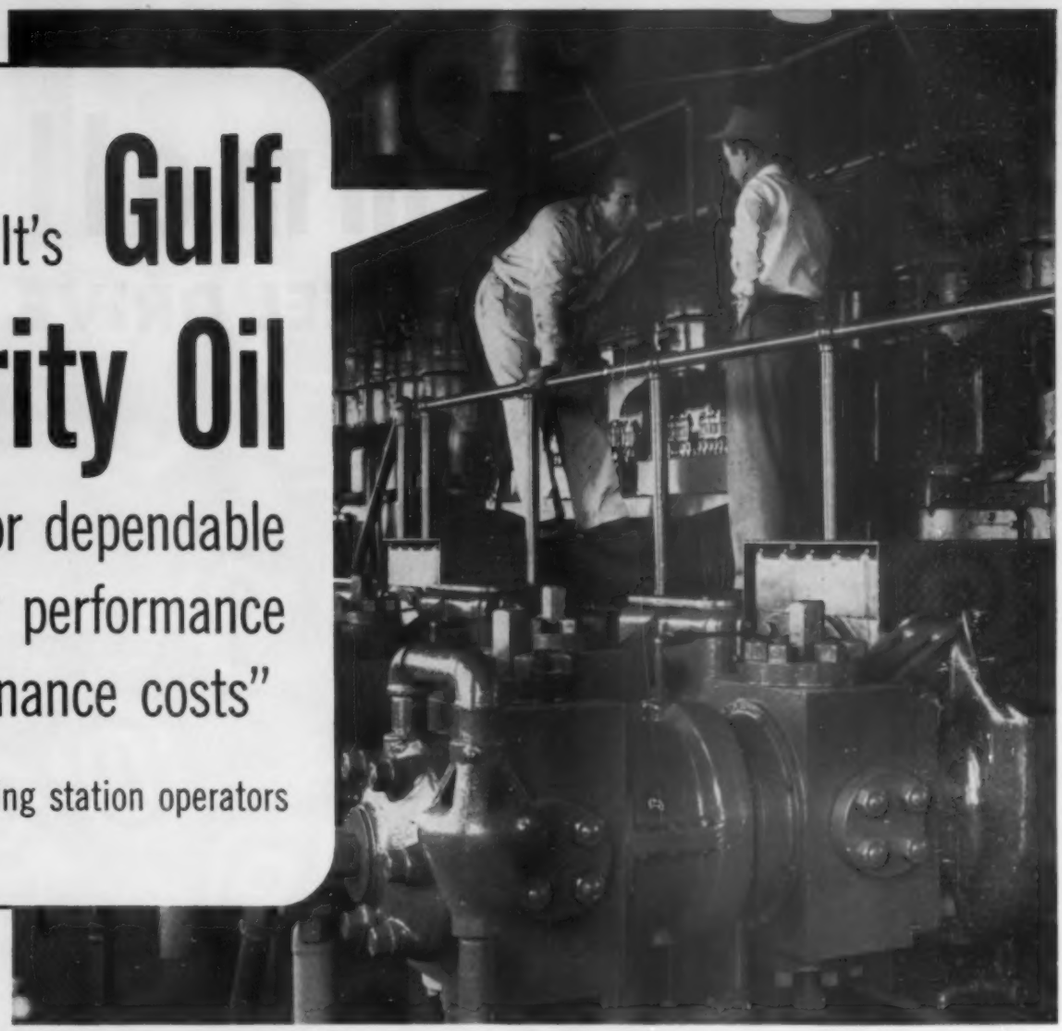
WORLD PETROLEUM REPORT

604 FIFTH AVE. NEW YORK 20, NEW YORK

"It's Gulf Security Oil for dependable gas compressor performance and low maintenance costs"

say pumping station operators



Smooth, continuous operation is a must for these units in service at a South Texas gas compressor plant. They are responsible for the steady flow of essential natural gas through pipe lines to homes and industries as far north as Detroit and New York. Gulf Security Oil provides the sure, effective protection needed for cylinders and bearings in both engines and compressors.

You can depend on Gulf Security Oil to provide the proper lubrication that is so important to vital compressor units if operating troubles are to be prevented and maintenance costs kept low.

Gulf Security Oil has a record of outstanding performance in scores of gas transmission plants. After years of operation with this quality oil, the cylinders and piston rings of both the compressors and power assemblies show negligible wear. And few carbon deposits have formed on power cylinder ports and pistons.

If you are installing new compressor units, or feel that you're not getting the most effective lubrication possible for your present units, it will certainly pay you to try Gulf Security Oil. Contact your nearest Gulf Office and have a Gulf Sales Engineer call.

Gulf Oil Corporation • Gulf Refining Company

1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA

GULF

The finest petroleum products for your every need

Scammell

FOUR AND SIX WHEEL DRIVE TRUCKS

Illustration above shows one of the many 6 x 6 Scammell "Constructor" Oilfields Bed Tractors operating in Kuwait and other major oilfields of the world.

Built to 'take it' *on or off the highway*

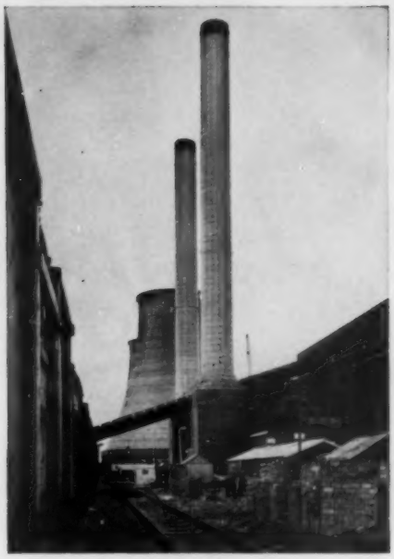
Scammell 4 x 4 "Mountaineer" Oilfield Tractor.

Scammell four and six wheel drive trucks have been specially designed for operation under the most gruelling conditions. In tropical heat, in the Arctic snowy wastes, in soft, sandy or mountainous terrain—in fact wherever the going is rough and tough Scammell trucks provide the complete, economical and reliable answer for every type of oilfield transportation.

Scammell four and six wheel drive oilfield type trucks and tractors have chassis designed for mounting Well-servicing Hoists, Cranes, Excavators, Drill Rigs, Cement Transit Mixers, etc., etc.

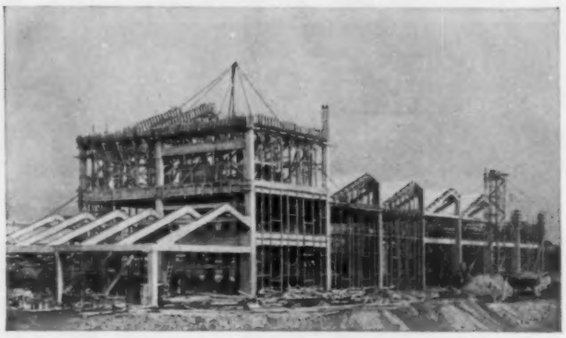
Further details gladly sent on request.

SCAMMELL LORRIES LTD., WATFORD, HERTS., ENGLAND ***Telephone: Watford 5231; Telegrams: Twelfton, Watford***



EXPERIENCE

TRAVELS



LIGHT

For more than 40 years Tileman have specialised in all forms of concrete construction. Their accumulated experience goes abroad to the furthest parts of the world, where Tileman teams are completing important contracts under the most diverse types of operating conditions.

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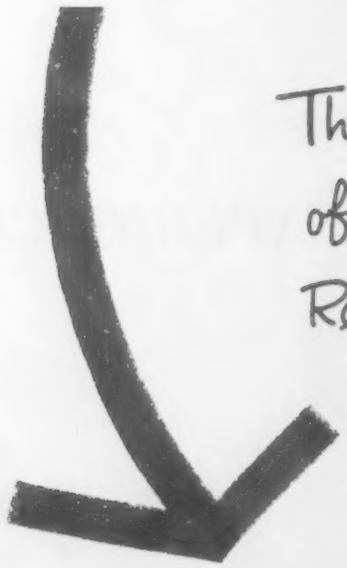
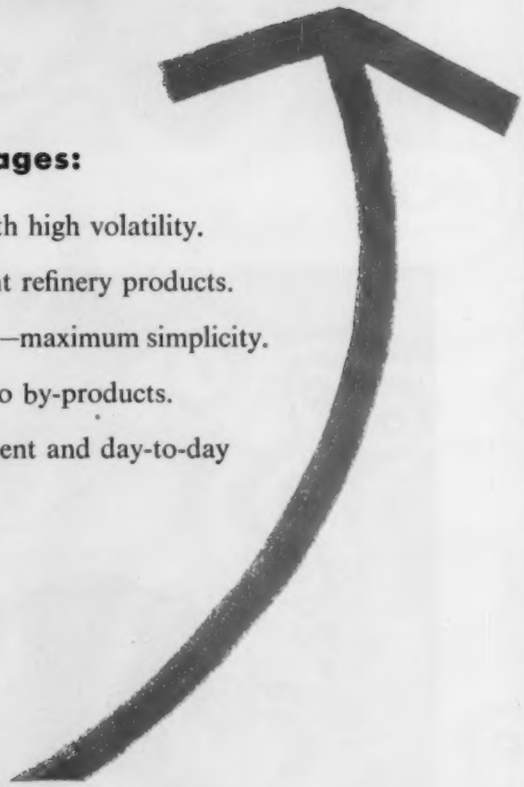


This is an announcement
of a brand new
Refining Process developed by
Universal Oil
Products Company

PEN



PENEX offers these advantages:

1. Provides a high octane product with high volatility.
2. Upgrades natural gasoline and light refinery products.
3. Affords mild, continuous operation—maximum simplicity.
4. Clean reaction—insignificant loss to by-products.
5. Economy, both in original investment and day-to-day operation.

PENEX is an entirely new refining process which enables the refiner and natural gasoline manufacturer, for the first time, economically to upgrade his pentane and hexane fractions. It is a simple, continuous process that does not require regeneration, and utilizes a fixed-bed platinum-containing catalyst.

PENEX

TRADEMARK

PENEX converts the low octane straight chain pentanes and hexanes into the much higher octane iso-compounds, accomplishing this through a clean reaction with little or no loss to by-products. Unconverted portions of the feed stock are separated and recycled to provide the ultimate in octane improvement. This new process employs mild operating conditions, and the non-corrosive nature of the catalyst assures easy and long-sustained operation.

PENEX is available NOW!

PENEX is an important advancement in petroleum refining technology. It is ready to be put to work now. All refiners, everywhere, should investigate this new process fully either for early application or for consideration as part of their future planning.

UOP

UNIVERSAL OIL PRODUCTS COMPANY
30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

Forty Years Of Leadership In Petroleum Refining Technology

CIMENT FONDU
Regd Trade Mark
ALUMINOUS CEMENT

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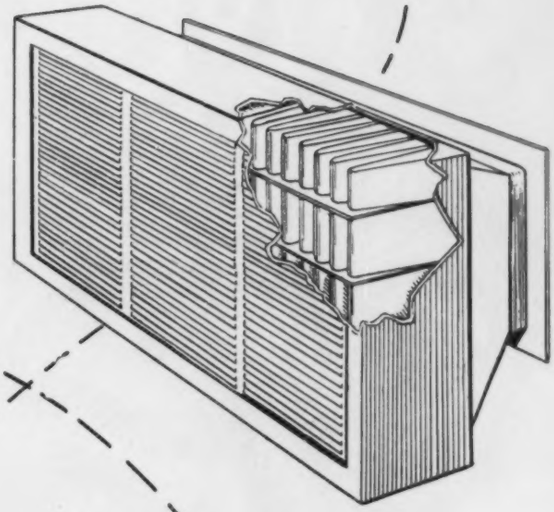

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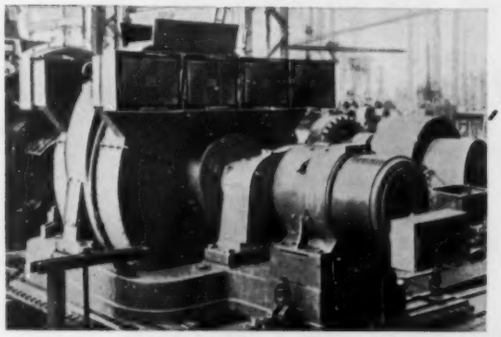

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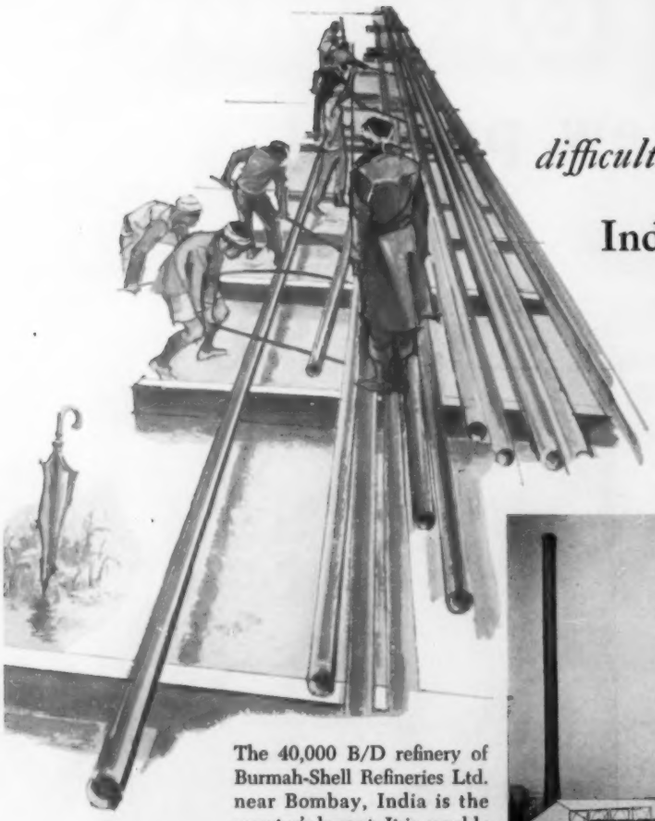
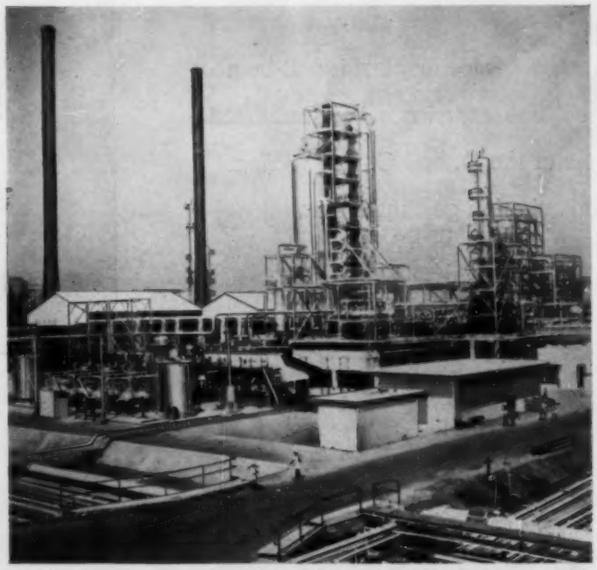


difficult physical conditions, but...

India's largest refinery was completed a year ahead of schedule



The 40,000 B/D refinery of Burmah-Shell Refineries Ltd. near Bombay, India is the country's largest. It is capable of supplying an estimated half of India's current requirements for finished petroleum. Although built in the face of difficult physical conditions, close cooperation with the owner in planning and engineering, and exceptional coordination of construction allowed Lummus to finish almost a year ahead of the original schedule.

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THIS MONTH'S COVER

Nestled in the hills of western Pennsylvania near Pittsburgh is the $11,000,000 Oakford storage compressor station jointly owned by New York State Natural Gas Co. and Texas Eastern Transmission Corp. The world's largest underground natural gas storage unit is described on page 56 of this issue. Color plates are reproduced here through the courtesy of the editors of *The Inch*, house magazine of Texas Eastern.

OIL FAMILY

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Higher Crude Prices Must Come

HIGHER PRICES for crude oil in the United States are inevitable if the industry is to maintain its traditional position. The only questions remaining unanswered are when the increase will take place and to what extent it will reach. Petroleum analysts and statisticians who make it their business to follow the trend of developments in the industry are agreed that the hour for such revision is close at hand, if not overdue, at the present time.

With the growth in demand steadily outstripping the increase in supply, the cost of operation leaves a constantly narrowing margin within receipts. The most recent authoritative survey of this subject, conducted by a joint committee representing the American Petroleum Institute, the Independent Petroleum Association of America and the Midcontinent Oil and Gas Association and made public at the end of April confirms the growing strength of this trend, although it was confined to expenditures for exploration, development and production for the years 1944, 1948 and 1953, the latter being the latest year for which official figures were available at the time when the study began.

The statistics for this period of slightly less than ten years, covering the cash outlays of the petroleum industry for exploration, development and production alone, without including many essential business charges, rose from $2.1 billion in 1944 to $6.4 billion in 1953. The cost per barrel advanced from $1.47 in 1944 to $3.16 in 1953.

Combining expenditures per well for exploration and development, statistics collected in the latest inquiry, which have been checked in various ways to verify their application to the industry as a whole, show that expenditures of producers increased from $1.47 per barrel in 1944 to $3.16 in 1953, a rise of 115 percent for slightly less than a decade.

While the total income of operators from petroleum was estimated to have grown from two billion eleven million dollars in 1944 to six billion 471 million in 1953, or, on a per barrel basis of net crude production, from $1.39 to $3.17, the committee points out that this does not represent a similar gain in profit for the reason that its investigation considers only cash outlays involved in exploration, development and production without covering other costs.

As in other mining and metal industries, withdrawals of petroleum from year to year represent a gradual diminution of supply which will lead to ultimate exhaustion. Natural conditions make it impossible to replace supplies that are used except at ever increasing costs, and producers are in the position of constantly disposing of their stocks at less than the cost of renewing them.

By intensive search for new sources of supply and by drilling to greater and greater depths, petroleum operators were able until recently to find new deposits sufficient to supply domestic requirements and to provide a balance for export. This position already has changed to the point where roundly a million barrels daily of imports are required and dependence on imports is certain to increase from year to year. Increasing depths multiply the cost of discoveries and the number of wells of high production grows less and less among those that yield profitable returns. As compared with the five-year period just preceding World War II, the American industry found it necessary to drill twice the footage in 1955, or upward of 62 feet for each barrel of new production. There is no assurance that the rate of return will improve in the future but every indication that the average cost will continue to rise.

By combining the evidence presented with that contained in previous studies, however, it becomes evident that the trend toward higher costs and diminishing returns from a given expenditure of effort and capital has been in operation for a long period but has been proceeding with greater speed and vigor in the past few years than at any previous time. Not only is it necessary to assume the cost of deeper drilling to procure an equal volume of new production, but the number of prolific and therefore profitable fields brought in is far less than formerly. The fifty-million-barrel field has disappeared from the yearly records of discoveries and even a million-barrel find is exceptional.

The fact that gross revenues from the sale of petroleum during 1955 were some ten percent greater than in 1953 is quoted to prove that the present depletion rate is ample to provide for the economic health of the industry, but in reality it compared with an increase of roundly twenty percent in basic costs and added less than ten percent to reserves. The industry still faces the problem of selling its assets at less than replacement costs.

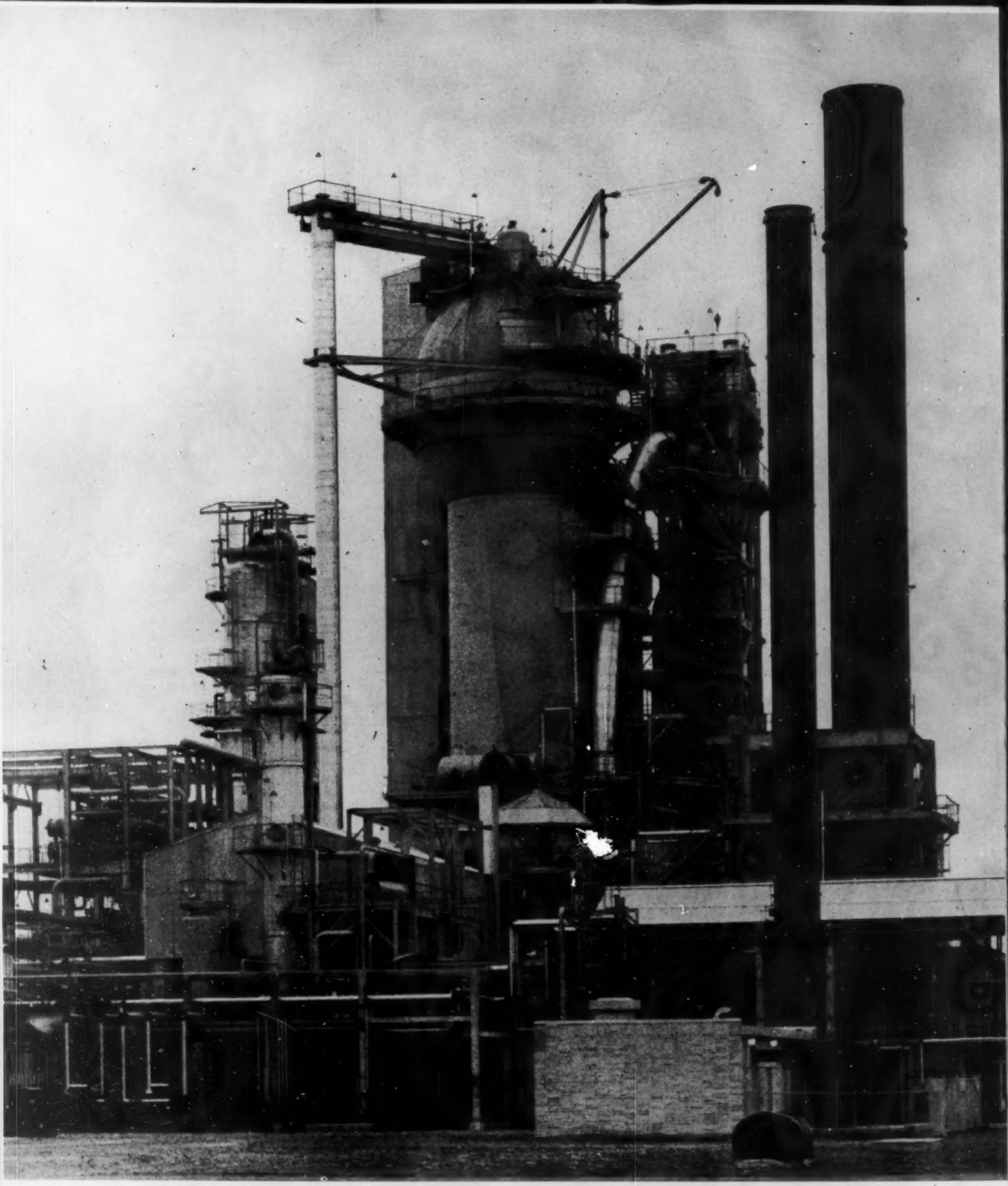


Fig. 4—Visible in this view of the new two-stage catalytic cracking unit at Shell Oil Company's Anacortes, Washington refinery are: fractionator (left rear, with a small scrubber in front). Flue gas line from the catalyst regenerator, catalyst regenerator (large cylindrical vessel, center), reaction system, and flue gas blower (far right). (Photo courtesy of Shell Oil Company).

First commercial unit of a two-stage catalytic cracker has been on stream at Anacortes, Washington, since January. Vaporized virgin gas oil is contacted concurrently with catalyst at high temperatures in a riser. Contact time is very short. Uncracked or partially converted gas oil is cracked further in a fluid bed reactor. Varying conditions in the two reaction zones gives great operating flexibility.

TWO-STAGE FLUID CRACKING... *a new technique*

HIGHER gasoline and lower coke yields have been attained in the new fluid cat cracker recently erected at Anacortes, Washington by Shell Oil Co. The new technique involves two-stage operation to segregate virgin and recycle stock in the processing scheme.

A description of the research behind the new cracker and commercial results obtained was given to the recent mid-year meeting of the American Petroleum Institute Division of Refining at Montreal by J. D. Heldman, F. Kunreuther, J. A. Marshall and C. A. Rebbein of Shell's technical staff.

Reviewing catalytic cracking development in the 14 years since the fluidized technique was introduced the authors noted that three methods have been employed to improve yields and selectivity. High temperatures have increased olefin yield in special cases even though total gasoline recovery was reduced. Recycle of gas oil has been employed to improve selectivity. Feed stocks of varying refractory characteristics have been segregated to permit processing under optimum conditions.

It has been observed that it is necessary under conventional practice to compromise on operating conditions. Part of the stock is overcracked and part undercracked. This is particularly true with mixed feed of wide molecular and boiling range spreads. Feed stock segregation helps but does not cure this difficulty.

"To minimize these overcracking/undercracking losses, uniform oil/catalyst-contact-time is desirable," the authors told the API. "Moreover, this contact time should be short to avoid secondary reactions of the gasoline produced from the least refractory feed components. Under such conditions high-temperature operation is desirable since the coke reduction obtained is not accompanied by the usual loss in gasoline yield ascribed to secondary reactions. All of these considerations can be met by carrying out the initial cracking step in a short-contact-time riser reactor, operated at high temperature. Further benefits can be gained from use of a second (and possibly more) reaction stage to which unconverted material from the preceding stage is fed.

"The Shell two-stage catalytic cracking process was developed to combine the advantages of short-contact-time cracking and of multiple staging. Their use in finished process schemes has required investigation and development of new techniques in almost all phases of fluid catalytic cracking."

The major portion of Shell's experimental work was carried out at Houston research laboratory.

"Two pilot-scale catalytic cracking units were employed in the development of the cracking techniques and conditions used in the two-stage process, it was reported. The first-stage unit, consisting of an upflow riser reactor, a stripper, a regenerator, and product fractionation columns, is capable of continuous operation at throughputs up to eight barrels of feed per day. Second-stage cracking of gas oil from the first stage was accomplished in two dense-bed pilot plants. One of these, which has been described in a previous publication[1] operates semi-continuously at feed rates up to about one gallon per hour. The other dense-bed unit consisted of a modification of the dispersed-phase cracking pilot plant in which the stripper vessel was used as a dense-bed reactor. The ranges of cracking conditions investigated in most of the work were as follows:

	First-Stage	*Second-Stage*
Temperature, °F	875 to 1,050	900 to 1,000
Pressure, psig		
Oil contact time, sec.	2 to 15	10 to 40
Catalyst/oil ratio	3 to 50	2 to 15
Stage conversion, vol. %	20 to 70	15 to 70
Over-all two-stage conversion, vol.%	50 to 80	

[1] J. A. Marshall & J. W. Askins, Ind. Eng. Chem. 45, 1603 (1953).

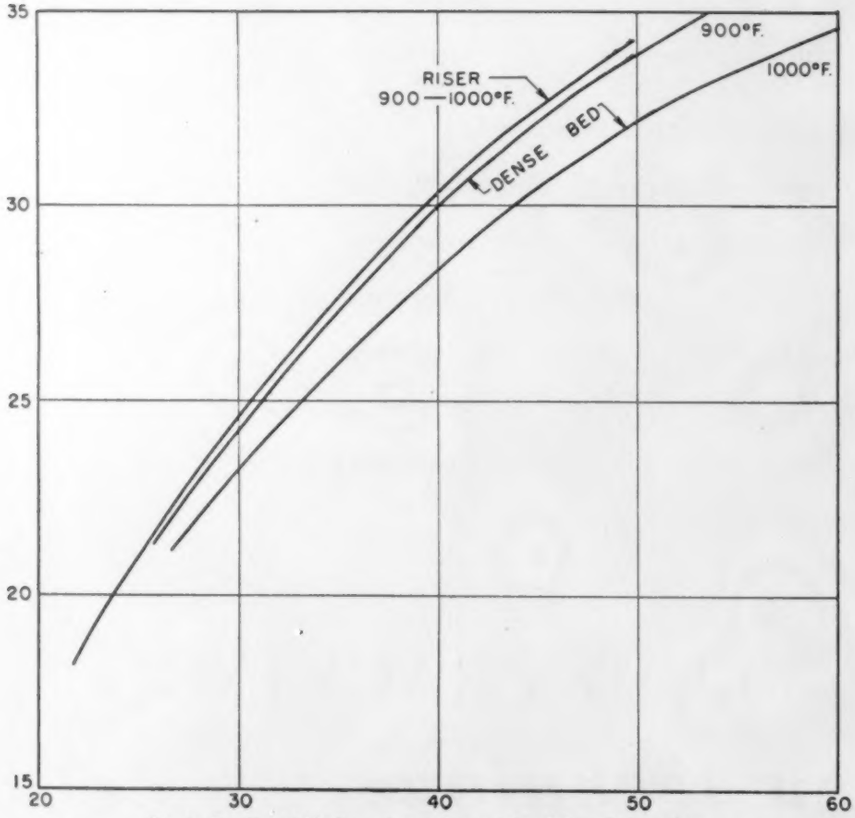


Fig. 1—Gasoline yields from riser and conventional dense-bed cracking.

TABLE 1

Catalyst Properties

(Commercial Equilibrium Synthetic Silica-Alumina)

Surface area, sq m per g	89
Pore volume, ml per g	0.25
Particle size distribution (by sedimentation), per cent by weight:	
< 40 microns	6
40 to 50 microns	12
50 to 60 microns	19
60 to 70 microns	18
70 to 80 microns	15
80 to 90 microns	12
90 to 100 microns	9
> 100 microns	9
Contaminants analysis, per cent by weight:	
Iron	0.12
Vanadium	0.003
Copper	0.0012
Nickel	0.003
Chromium	0.0041

TABLE 2

West Texas Feed Stock Properties

API gravity	29.1
ASTM distillation, degrees fahrenheit:	
IBP	450
10 per cent by volume	540
50 per cent by volume	660
Pour point, degrees fahrenheit	+70
Ramsbottom carbon residue, per cent by weight.	0.15
Sulfur, per cent by weight	0.57
Kinematic viscosity at 100 F, cs	13.5

"Most of the pilot plant operation, employing two separate units, was equivalent to parallel flow of catalyst—that is, freshly regenerated catalyst was used in each stage. In other experiments, series flow was employed; i.e., partially spent catalyst from the first stage was used in the second stage.

"Several commercial equilibrium catalysts and a wide variety of commercial and experimental feed stocks were used in these studies. However, except where otherwise stated, the results presented in this paper were obtained with West Texas flashed distillate and equilibrium microspheroidal catalyst withdrawn from Shell's Houston refinery. During the pilot plant investigation, several large batches of this catalyst and feed were used. The properties shown in Tables 1 and 2 are typical of the materials employed.

"In addition to the development of cracking techniques and conditions used in the two-stage process, the engineering aspects of fluidization, catalyst transport, catalyst-gas separation, stripping, and regeneration were investigated on pilot plant, semicommercial, and commercial scales. These studies, which included the use of radioactive tracers and gamma ray attenuation, involved detailed evaluations of the performance of six commercial units of varying designs. Stripper performance and the pressure drops and catalyst flow patterns in the standpipes and risers of these units were investigated extensively. A semicommercial stripper and a semicommercial riser capable of transporting one ton of catalyst per minute were operated to develop novel designs and to provide data on stripping and on catalyst flow. These same units and others were also used to obtain data for design of the high-capacity cyclones required for the separation of first-stage products from the catalyst.

Process Development

"Short-Contact-Time Riser Cracking. The upflow riser-reactor pilot plant operated as the first-stage reactor demonstrated the advantages that can be obtained from short-contact-time riser cracking vs. conventional fluid bed cracking. The superiority of the riser technique is evident from Fig. 1 and 2, which show gasoline and carbon[2] yields, respectively, from riser and dense-bed cracking at both 900 and 1,000°F.

"The advantage of the riser is magnified at the higher temperature. In riser cracking, the increase in temperature serves to decrease coke production without affecting gasoline yield, whereas an accompanying decrease in gasoline is experienced in dense-bed processing.

"The superiority of the riser technique shown in Fig. 1 and 2 is the result of three factors: 1, establishment of uniform residence time and reduction of dilution of feed by cracked products due to the concurrent flow of catalyst and oil vapor, 2, better contacting efficiency between catalyst and oil, and, 3, higher average catalyst activity. These factors permit operation at high conversions with little destruction of cracked products, thereby resulting in lower coke and higher gasoline yields.

"In addition to the above benefits of riser cracking, it was also found that the over-all severity for achieving high conversions (70% and higher) could be kept much lower in two-stage cracking. This is the result of processing the more refractory gas oil from first-stage cracking in the absence of the diluent gas and gasoline produced up to the first-stage conversion level.

"After the feasibility and superiority of riser cracking had been established in principle, attention was turned to those questions which had to be answered before a successful integrated process design embodying the potential gains could be made.

"Temperature—Catalyst Flow. A detailed study of the effect of temperature variations in the two reaction stages was made. From the various possibilities, a higher riser (first-stage) temperature and lower second-stage temperature was chosen. This temperature sequence is obtained commercially with series flow of catalyst from the first to second reactor stage. Pilot-plant experiments in which series flow of catalyst

[2] In this paper, carbon yield is reported for pilot plant experiments; and coke yield, including hydrogen associated with the carbon, is reported for commercial plant results.

was employed showed that the low level of coke deposited on the catalyst in the first stage has no effect on product distribution in the second stage.

"First-Stage Conversion Level. The pilot-plant studies showed that the optimum first-stage conversion level was primarily dependent upon feed stock quality and dependent to a lesser extent on total conversion and temperature sequence. The over-all catalytically cracked gasoline yield obtainable peaks rather sharply at a particular first-stage conversion for any given feed and coke make. The first-stage conversion which leads to a maximum gasoline may not be optimum from an economic standpoint, of course, depending on the downstream processing facilities: for example, polymerization vs. alkylation of olefins, the marketing situation, and other factors. Economic evaluations using typical product values showed that first-stage operation at conversions differing somewhat from optimum does not incur significant economic penalties. This is an important consideration in process flexibility."

Widely different feed stocks were investigated during the research. Comparisons for some are summarized in Table 3.

"The differences in the yields of gaseous hydrocarbons are due in part to the cracking temperatures employed in the comparisons and in part to the processing techniques. At constant temperature and conversion, less dry gas is produced in riser cracking than in dense-bed operation, but the trend of increasing gas production as temperature is raised holds with either method of operation. These two factors explain the increased gas make for the two-stage cracking results shown for West Texas and Redwater compared to single-stage cracking at 900°F, and the decreased gas make for Los Angeles Basin compared to single-stage operation at 1,000°F.

"The major differences in quality of the products from conventional single-stage and the present two-stage cracking process are in the compositions of the gasolines as shown in Table 4. The properties of the final gas oils produced by the two techniques are essentially the same when compared at constant conversion. The differences which do exist can be explained largely on the basis of the different conversions obtained at a given coke yield.

"Despite the large variations in the compositions of the gasolines produced in the various processes, the leaded Research method octane ratings of these gasolines are essentially the same. The calculated Research method +3 cc TEL ratings of the total 10 lb. RVP gasolines from all the proc-

TABLE 3

Comparison of Single-Stage and Two-Stage Cracking of Various Feed Stocks

Crude source	West Texas			Redwater		Los Angeles Basin	
Feed properties:							
API gravity	29.1			23.0		25.2	
Sulfur, per cent by weight	0.57			0.70		1.25	
Ramsbottom carbon residue, weight %	0.15			1.0		0.3	
Precision distillation, volume %:							
IBP to 450°F	3			1		1	
450°F to 615°F	35			9		27	
615°F +	62			90		72	
	Single-Stage						
	Single Pass	Total Gas Oil Recycle*	Two-Stage	Single-Stage	Two-Stage	Single-Stage	Two-Stage
Cracking temperatures, °F	900	900	1,000 to 900	900	1,000 to 900	1,000	1,000 to 950
Catalytic cracking yields, vol. %:							
Ethane and lighter (scf/bbl)	(190)	(190)	(300)	(195)	(230)	(415)	(290)
Propylene	7.6	7.1	9.5	4.9	7.5	6.4	7.8
Propane	4.2	3.8	3.8	3.2	2.9	3.9	3.7
Butylenes	8.2	8.8	10.9	7.0	8.8	8.1	9.0
Isobutane	9.4	8.3	4.5	5.8	3.9	3.8	4.6
nButane	1.8	1.5	1.5	1.1	0.8	1.1	0.9
Amylenes	4.8	5.5	6.6	4.9	7.6	5.2	6.4
Isopentane	6.5	6.9	3.8	4.5	2.6	2.0	2.5
nPentane	0.3	0.3	0.3	0.4	0.3	0.4	0.1
Depentanized gasoline (113°F to 450°F)	24.2	32.2	37.5	33.5	41.9	28.8	38.6
Light gas oil (450°F to 615°F)	23.5	19.3	16.7	17.9	13.2	22.6	19.4
Heavy gas oil (615°F+)	18.0	14.7	11.2	20.5	12.8	18.9	11.8
Carbon, weight %	5.2	5.2	5.2	8.5	8.5	6.5	6.5
Conversion	58.5	66.0	72.1	61.6	74.0	58.5	68.8
Total yield of 10 lb RVP gasoline †	49.9	59.5	67.4	55.5	67.7	50.8	64.8

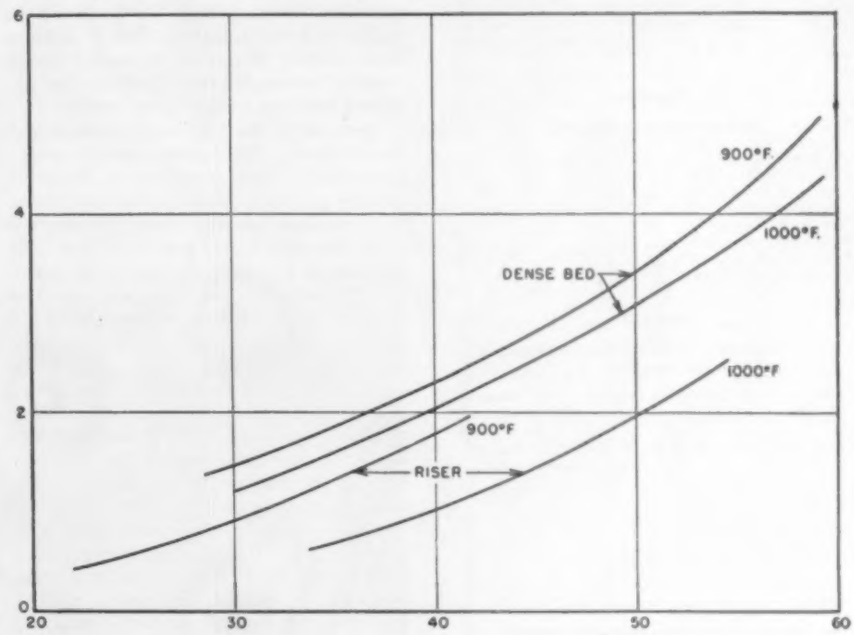
* Total feed ÷ fresh feed = 1.6.
† Based on polymerization of propylene and butylenes, and blending butane to 10 lb RVP.

TABLE 4

Properties of Products from Two-Stage and Conventional Catalytic Cracking

	Single-Stage		
	Single Pass	Recycle	Two-Stage
Carbon yield, weight %	5.2	5.2	5.2
Conversion, volume %	59	66	72
Product properties:			
Depentanized gasoline			
API gravity	45.5	46.3	46.0
Sulfur, weight %	0.08	0.08	0.14
Maleic anhydride value	8	7	18
Hydrocarbon type analysis, weight %:			
Olefins	16	26	43
Aromatics	50	44	37
Saturates	34	30	20
Octane ratings (neat):			
Research method +3 cc TEL	98	98	98.5
Light gas oil			
API gravity	28.0	27.3	26
Aniline point, °F	123	116	113
Kinematic viscosity at 100° F, cs	3.2	3.1	3.0
CFR calculated cetane number [23]	37	35	32
Heavy gas oil			
API gravity	23.5	22	20
Ramsbottom carbon residue, weight %	0.8	0.3	0.7
Kinematic viscosity at 100° F, cs	14	13	13

Fig. 2—Carbon yields from riser and conventional dense-bed cracking.



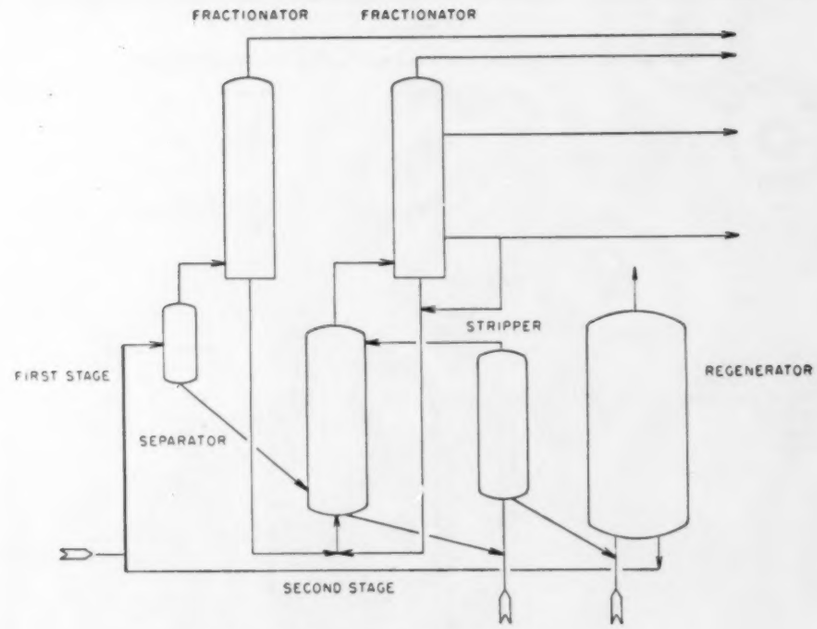


Fig. 3—Schematic flow diagram of Anacortes catalytic cracking unit.

TABLE 5

Two-Stage Yields from Cracking Total First-Stage Gas Oil vs. Heavy First-Stage Gas Oil in the Second Stage

	Second-Stage Feed	
	Total Gas Oil *	Heavy Gas Oil †
Total conversion, vol. %	72	67
Yields, vol. %:		
Debutanized gasoline (IBP to 450°F)	48.2	43.8
Light gas oil (450°F to 615°F)	16.7	25.8
Heavy gas oil (615°F+)	11.2	7.6
Carbon, weight %	5.2	5.2
Total 10 lb RVP gasoline, vol. % ‡	67.4	62.7

* Total feed to both stages ÷ fresh feed = 1.6.
† Total feed to both stages ÷ fresh feed = 1.3.
‡ Based on polymerization of propylene and butylenes, and blending butane to 10 lb RVP.

TABLE 6

Alberta Feed-Stock Properties

API gravity	23.7
ASTM distillation, °F:	
IBP	508
10 volume %	620
Pour point, °F	+85
Ramsbottom carbon residue, weight %	0.83
Sulfur, weight %	1.26
Viscosity at 210°F, SSU	51

TABLE 7

Catalytic Cracking of Mixed Alberta Feed Stock at Anacortes

	Yields (Per Cent by Volume)
Ethane and lighter (std cu ft per bbl)	(340)
Propylene	8.0
Propane	4.5
Butylenes	12.7
Butanes	5.1
Debutanized gasoline	53.3
Light gas oil	12.2
Heavy gas oil	12.4
Coke, weight %	6.5
Conversion	75.4

esses fall in the range 100.0 to 100.5 octane number.

"The higher olefin and lower aromatic content of two-stage gasoline result from the fact that a very substantial portion of the gasoline is produced in the first stage where the conditions are such that olefin saturation and recracking are avoided. While the total amount of aromatics in the various gasolines does not vary widely, the concentration of aromatics in two-stage gasoline is much lower due to the increased amount of olefins produced.

"The somewhat higher sulfur content of two-stage gasoline is also attributed to avoidance of recracking. This increase in sulfur does not present a serious problem with most U. S. crudes; however, special treating techniques will probably be required with some high-sulfur crudes.

"Because of the high olefin content and the relatively high diolefin content, extensive stability tests, including an 18-month storage program, were carried out. Since the first-stage gasoline would be expected to be the least stable portion of the total gasoline, it was used in these tests rather than the combined two-stage gasoline. The results of the storage program indicated that the first-stage gasoline when properly inhibited initially, is as stable as conventional catalytically cracked gasoline.

"Engine cleanliness tests were also carried out on the first-stage gasoline. The results of these tests showed that this gasoline is comparable with a typical commercial premium gasoline. The stability of first-stage (and therefore two-stage) gasoline, despite the rather high diolefin content, is attributed primarily to the boiling range of the diolefins. Analysis of several fractions of the gasoline showed that the diolefins are concentrated in the lower boiling portion, which do not contribute markedly to gum formation.

"*Flexibility.* In the Shell two-stage cracking process, considerable flexibility is available for changing the yield structure from any given feed stock. Gasoline yield can be increased further by incorporating recycle into one of the cracking stages. The yield of light gas oil can be increased substantially by charging only heavy gas oil to the second stage.

"A comparison of two types of two-stage operation, namely, with total first-stage gas oil and with heavy first-stage gas oil only going to the second stage, is shown in Table 5. These data are on the same basis (5.2-per-cent-by-weight carbon) as, and therefore comparable with, the West Texas data given in Table 3. The 9% increase in light gas-oil yield is realized partly at the expense of heavy gas oil and partly because of the lower total conversion. However, despite the increased light gas-oil yield and the 5% lower conversion, the gasoline yield is decreased only 4%. Furthermore, the light gas oil produced in this way is of high quality. Of course, gains in yield and quality could be achieved in conventional recycle operation by recycling only heavy gas oil, but the difference between comparable two-stage cracking and recycle cracking operations would be essentially the same as that shown in Table 3. It is significant, however, that the two-stage process operated for maximum intermediates rather than maximum gasoline, i.e., cracking of only heavy gas oil in the second stage, produces 3% more gasoline than conventional recycle cracking of total gas oil at roughly the same total conversion."

The authors reported that new design features were tested in various sizes and found satisfactory over a wide range of operating conditions. First commercial plant went on stream at Anacortes, Washington, last January with the flow scheme shown in Fig. 3. A photograph of the unit is reproduced as Fig. 4.

At Anacortes fresh feed is contacted in a riser reactor with regenerated catalyst. The product vapors and partially spent catalyst are separated, the former going to a fractionator and the latter routed to the second-stage reactor to which gas oil from the first-stage fractionator is fed. Spent catalyst is stripped, regenerated, and returned to the riser reactor.

The unit has operated on a mixture of Alberta feeds. Typical properties are shown in Table 6. Plant yields with this feed mixture are given in Table 7.

In concluding their paper the authors stated that "single-stage riser reactor units have been designed to take advantage of the increased selectivity where high conversion is not required, as is the case in some refining situations. Existing fluid units can, in some instances, be modified to take advantage of the short-contact-time and two-stage principles by addition of a riser reactor and other facilities."

Oil exploration rights have been granted to 12 companies, including eight independents seeking to find new reserves. A second grant of exploration rights is being considered with 30 licenses available for the 70 applicants who have shown interest.

Behind this structure is a terminal owned by Mobil Oil Turk, an affiliate of Socony Mobil. The front was built to harmonize with local architecture in Beikos, a suburb of Istanbul. (All photos used through courtesy of Socony Mobil Oil Co.)

Oil Laws and Exploration in TURKEY

Until early 1954, at which time a new petroleum law became effective, exploration in Turkey was a monopoly of the government's Mining Research and Exploration Institute. By March 1, 1956, with the passage of the Amendment Law of 1955 and Regulations under Petroleum Law of March 7, 1954, 12 companies had applied for 141 exploration licenses (indicated on the preceding map), having previously done some reconnaissance work under special permit. Subsequently Seaboard Oil of Dallas and Atlantic Refining have joined Tide Water Associated in exploration.

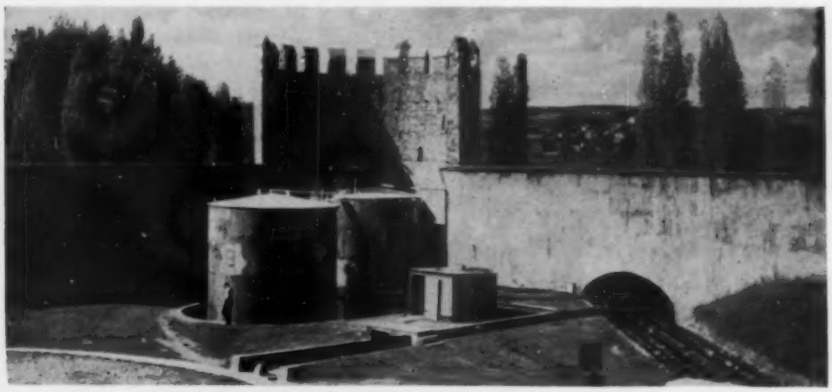
Turkey is now considering granting a second round of oil rights under the new petroleum law. An additional 30 licenses may be offered.

The government has received 70 applications for the areas with no overlaps on eight of them. There are 62 applications on file for the 22 other leases.

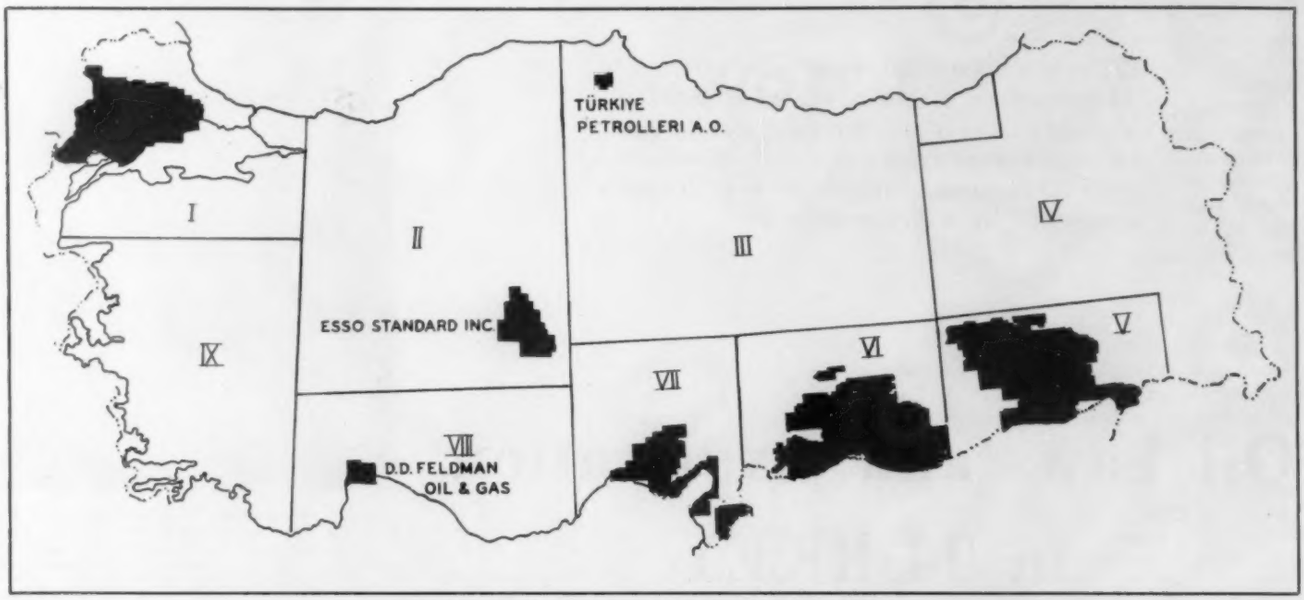
The country has been divided by the Petroleum Law into nine zones, indicated on the map by roman numerals. Esso Standard (Turkey) Inc., owned by Standard Oil Company (New Jersey), was granted four licenses in District I, eight in District II, six in District V, seven in District VI, and two in District VII. Bataafsche Petroleum Maatschappij, of the Shell Group, was granted five licenses in District I and eight each in Districts V and VI. Tide Water Oil Company, an American independent, received three licenses in District I, eight in District V and six in District VI. D. D. Feldman Oil and Gas Inc., also an American independent, received one license each in District VI and District VII and two licenses in District VIII.

Turkyie Petrolleri A.O. or Turkish National Oil Company, which is owned 51% by the government of Turkey and 49% by private Turkish capital, received two licenses in District I, one in District III, six in District V, five in District VI, and one in District VII. Seven companies who had applied before October 15, 1955, received licenses later because of overlapping. They included Mobil Exploration Mediterranean, a subsidiary of Socony Mobil with eight licenses each in Districts V, VI, and VII; Gilliland Oil Corporation, a U. S. independent, with one license each in Districts V and VII; Bolsa Chica Oil Company, an American independent with three licenses in District V and two in District VII; and the

Rear view of Mobil Oil Turk's Beikos terminal, showing installations masked by decorative masonry



This article is based on one of a series of national reports, which are available through World Petroleum. They cover 45 countries and are designed for companies interested in operations abroad. The material deals with laws and regulations affecting petroleum exploration and production, as well as developments in refining and marketing. Investment factors such as taxation and exchange controls are discussed and concession maps reproduced. Inquiries should be addressed to WORLD PETROLEUM REPORT, 604 Fifth Avenue, New York 20, New York.



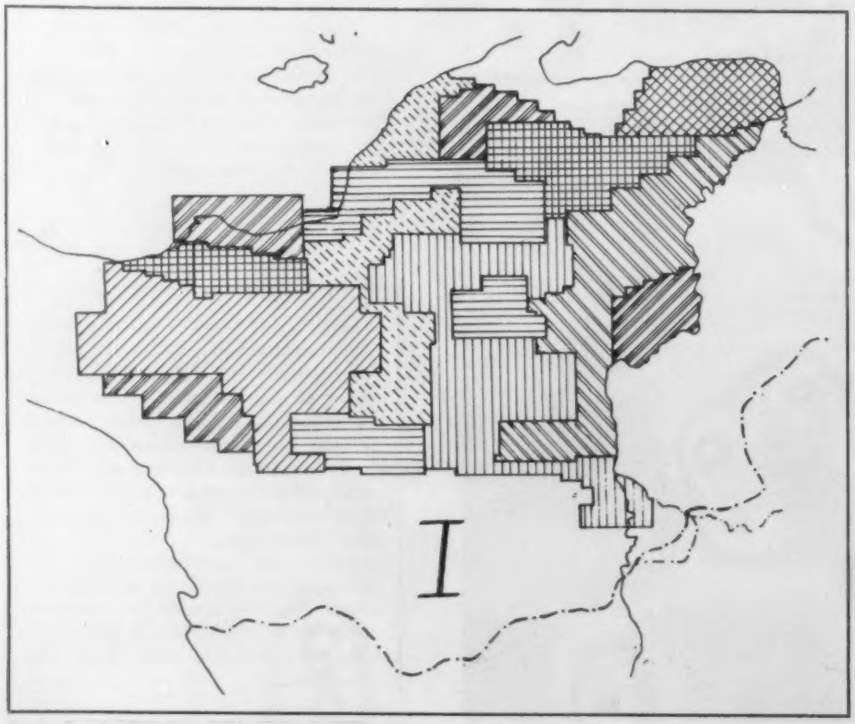
Petroleum Exploration Licenses in Turkey (As of March 1, 1956)

Istanbul Tabii Gas Lts. Sirketi or Istanbul Natural Gas Company which is 70% owned by the Ralph M. Parsons Company, 20% by the Istanbul Elektrik ve Gas and 10% by the Turkiye Petrolleri A.O., with four licenses in District I and one in District VII.

In Thrace or European Turkey, in District I, Husky Oil Corporation, a U. S. independent holds four licenses and the German firm, C. Deilman Montan G.m.b.H. also received four licenses. American Overseas Petroleum Ltd., owned by California Texas Oil Company, received five licenses in District I and eight in District VI.

Gilliland Oil plans a wildcat during early summer in the Iskenderun Gulf area along the Mediterranean Sea. There are two known structures in Gilliland's exploration areas, one known as the Rubaikale structure near the border of Iraq. The other is on the coast and is an anticlinal structure, lying partly offshore.

Previous exploration carried out over 20 years by the Government monopoly has not resulted in any major discoveries as yet. Work has been concentrated in southeastern Anatolia, particularly in the Ramandag district and toward the Lake of Van.

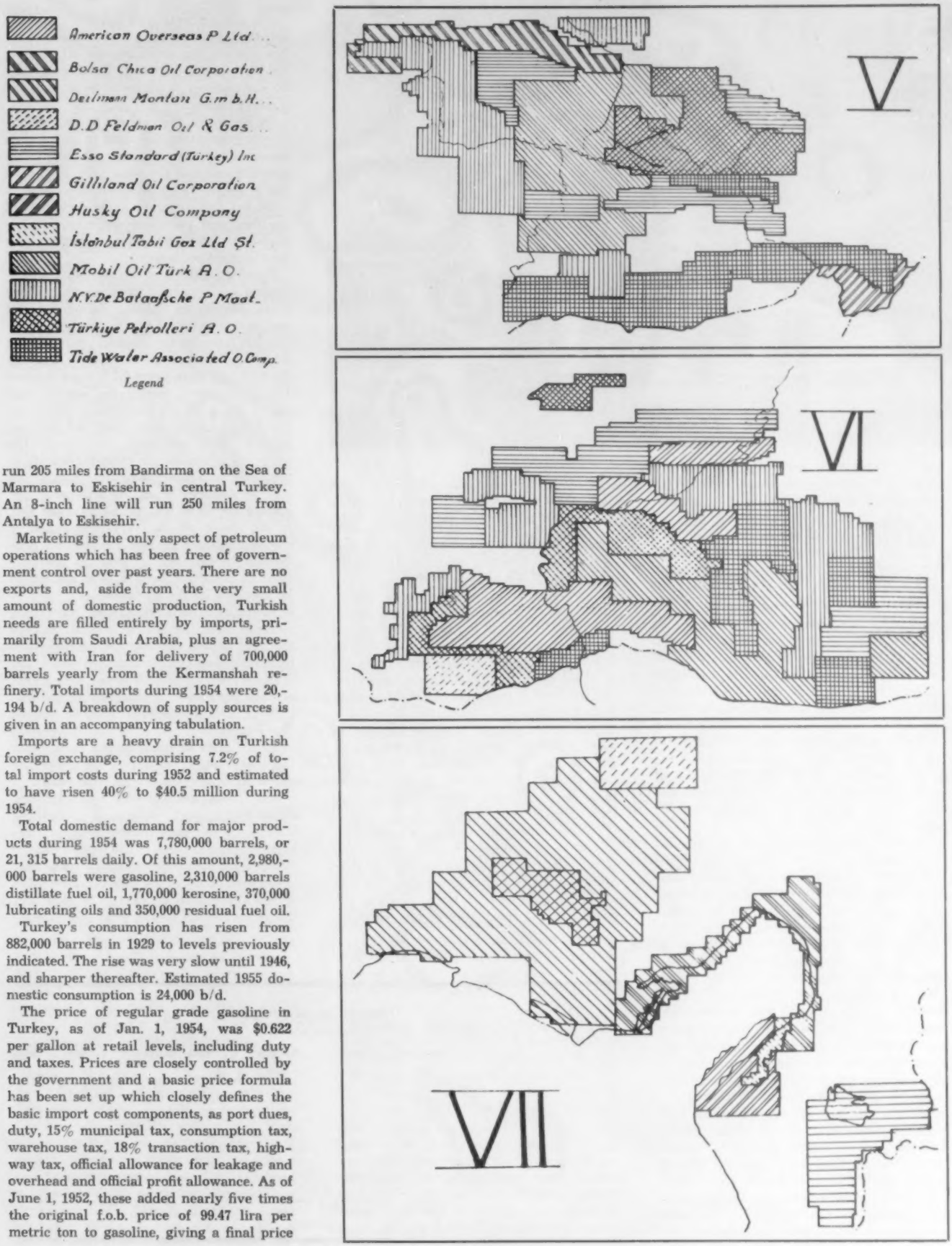


Production to date has been in the Ramandag area in southeastern Anatolia in the Raman and Garzan fields. There has been no commercial production from the Garzan field, which was discovered in 1950. During 1955, production from the Raman field was 3,500 b/d. Total cumulative production since discovery in 1948, and through 1955, was 2,380,000 barrels.

The potential of the Raman field is estimated at over 7,000 b/d, but it is held in by lack of transportation and refining facilities. During early 1955 the completion of the Batman refinery lifted production to about 6,000 b/d.

A new refinery at Batman, which was completed in December 1955, is the only large one in Turkey. It is owned 55% by the government and its operation is considered entirely separate from the policy of encouragement of foreign private investment in exploration and development. The refinery utilizes crude from the government's Raman and Garzan fields and has a capacity of 6,250 b/d, which goes mainly to the consuming needs of the surrounding 19 provinces which are relatively isolated, due to topography. There has been a small topping plant in operation at Batman since 1949. Throughput is small, about 250 b/d.

Construction of a 450-mile products line of four, six, and eight inches diameter began during September 1955. It will run from Iskenderun northeast to Batman for supply to NATO air bases. Two products lines for NATO are being laid by Cia. Technica Internazionale of Milan. One 4-inch line will



Legend

run 205 miles from Bandirma on the Sea of Marmara to Eskisehir in central Turkey. An 8-inch line will run 250 miles from Antalya to Eskisehir.

Marketing is the only aspect of petroleum operations which has been free of government control over past years. There are no exports and, aside from the very small amount of domestic production, Turkish needs are filled entirely by imports, primarily from Saudi Arabia, plus an agreement with Iran for delivery of 700,000 barrels yearly from the Kermanshah refinery. Total imports during 1954 were 20,-194 b/d. A breakdown of supply sources is given in an accompanying tabulation.

Imports are a heavy drain on Turkish foreign exchange, comprising 7.2% of total import costs during 1952 and estimated to have risen 40% to $40.5 million during 1954.

Total domestic demand for major products during 1954 was 7,780,000 barrels, or 21, 315 barrels daily. Of this amount, 2,980,-000 barrels were gasoline, 2,310,000 barrels distillate fuel oil, 1,770,000 kerosine, 370,000 lubricating oils and 350,000 residual fuel oil.

Turkey's consumption has risen from 882,000 barrels in 1929 to levels previously indicated. The rise was very slow until 1946, and sharper thereafter. Estimated 1955 domestic consumption is 24,000 b/d.

The price of regular grade gasoline in Turkey, as of Jan. 1, 1954, was $0.622 per gallon at retail levels, including duty and taxes. Prices are closely controlled by the government and a basic price formula has been set up which closely defines the basic import cost components, as port dues, duty, 15% municipal tax, consumption tax, warehouse tax, 18% transaction tax, highway tax, official allowance for leakage and overhead and official profit allowance. As of June 1, 1952, these added nearly five times the original f.o.b. price of 99.47 lira per metric ton to gasoline, giving a final price

Mobil service station in Turkey.

of 497.50 lira, of which only 20 lira was official profit.

Oil Exploration and Development Laws

There are no constitutional provisions governing petroleum in Turkey, as are so frequently found in other states. The controlling legislation is Petroleum Law 6326 as passed March 7, 1954, and published March 16, 1954, and the Regulations of March 1955. This law supplants previous legislation, which began with the Mining Code of 1906 patterned after French legislation and was later supplemented by the Petroleum Law of 1926. All provisions of previous laws are abrogated by the present law, which governs all activities except marketing and distribution.

Activities are divided under the law into three stages of permit, license (hereafter referred to as exploration concession), and lease (hereafter referred to as development concession). The entire country is divided into nine petroleum districts, of which three and four have been declared partly closed.

The law is administered by a Minister of Industrial Development through the Petroleum Administration, headed by a Petroleum Administrator. The government, among other things, has the power to select applicants by virtue of their technical and financial ability, experience, furtherance of the national interest, and compliance with laws. These standards are to be used in determining the recipient of the lands now under application, especially those which overlap. Should other factors be equal, priority of application will prevail. Among applicants which are barred are those wherein a foreign government has an interest, although either foreign or domestic companies may hold petroleum rights.

Under the law, special permits for geological reconnaissance may be given of a non-exclusive nature on terms left to the discretion of the Administrator.

Exploration The exploration license (hereafter referred to as the exploration concession) gives the right to explore the licensed area and geologically-related areas. The maximum area per exploration concession is 50,000 hectares (125,000 acres) per concession, with a maximum of eight concessions per person or corporation in one district, making a total possible exploration area of 400,000 hectares (1,000,000 acres) per district. The Regulations were published Sept. 13, 1955, and license applications for exploration were made 30 days thereafter, or about Oct. 13.

The concession duration is six years, with a right to two extensions of two years each at the Administrator's discretion if no discovery is made within five years. The explorer is obligated to begin drilling not later than the third year of his oldest license and continue with not more than six months lapse. Drilling on one license satisfies the drilling obligation on all licenses held in the same district. The license may be surrendered in whole or in part on one month's notice.

On discovery, the exploration concessionaire is guaranteed the right to convert his concession to a development concession covering one-half the same area. If discovery is made, the exploration concession is extended five years to allow definition of the field and the discovery may be produced, subject to the same obligations as a development concession.

Fiscal obligations of the exploration concession are comprised in an annual surface rental payable as follows: during the first and second years 0.5 lira per hectare ($0.07 per acre), during the third and fourth years 1.0 lira per hectare ($0.14 per acre), during the fifth and sixth years 1.5 lira per hectare ($0.21 per acre), during the seventh and eighth years 2.0 lira per hectare ($0.28 per acre), during the ninth year 2.5 lira per hectare ($0.35 per acre), and during the tenth and any following years 3.0 lira ($0.42 per acre) is payable. Exploration expenses may be deducted from the amount of the surface tax up to 80% of the total tax and, in the event of discovery, the rental is credited against royalty payable on production. In addition to the tax, a guaranty must be posed for performance, amount to be specified by the government.

Exploitation The development concession, referred to in the law as a lease, conveys the right to drill, develop, and produce. The maximum area per development concession is 25,000 hectares (62,500 acres) with a total acreage per person or company in one district of 150,000 hectares (375,000 acres). There is express provision against creation of subsidiaries or other means to increase the maximum acreage held in either the exploration or development concessions.

Any areas not covered by petroleum rights may be declared open to competitive bidding by the government, without obligation to give the area to the highest bidder.

The term of the development concession is 40 years, of which the five-year extension of the exploration concession is part, and it is renewable for 20 years more on govern-

TURKEY—IMPORTS, 1954
(Thousand barrels)

	gasoline	kerosine	fuel oils	lubricants	petrolatum	asphalt	Total
United States	819	628	618	277	7	16	2,365
Italy	—	—	3	—	—	16	19
United Kingdom	280	307	232	43	1	11	874
U.S.S.R.	66	21	—	—	—	—	87
Europe, other	10	34	—	53	5	64	166
Iraq	74	101	47	—	—	—	222
Saudi Arabia	890	569	1,169	—	—	—	2,628
British territories in Asia	440	196	369	—	—	—	1,005
Indonesia	—	—	—	—	5	—	5
Total	2,579	1,856	2,438	373	18	107	7,371

mental decision and on "reasonable" terms as specified by the Petroleum Administration. If the concession area is not already developed, drilling must begin within six months. Commercial production must begin with three years or the lease may be cancelled by the government on 90 days' notice. The concession may be surrendered in whole or in part at any time by the concessionaire, on three months' notice.

Producers may be required to sell at market price all petroleum needed for local consumption within Turkey, amount to be determined by the government, including ship's fuel (bunkers) and aviation needs. If a refiner, he must also refine the quantity supplied. The government may require production to the levels needed for Turkish consumption, short of exceeding maximum efficient producing rate, or past that proportion required of other producers.

Fiscal obligations of the development concession include an annual surface tax, or rental, of three lira per hectare ($0.42 per acre) during the first year, four lira per hectare ($0.56 per acre) during the second, five lira per hectare ($0.70 per acre) during the third year, six lira per hectare ($0.84 per acre) during the fourth, and eight lira per hectare ($1.12 per acre) during the fifth and following years. The amounts paid as rental are creditable against royalty paid during the same period and, if concessionaire is producing without yet having converted his concession, he is subject only to surface rentals given for exploration concessions.

There is a royalty payable of 12½% of petroleum produced, excluding field use or amounts returned to formation. It is payable in cash at average market price or in kind. If in kind, the producer may not be required to store liquid petroleum for more than thirty days or to store any natural gas.

Producers are exempted for 15 years following March 1954 from payment of import duties on materials and machinery used and from export tax on petroleum exported. In addition, there are given substantial deductions before payment of tax, including cost of goods purchased, amortization allowance, depletion allowance, losses due to damage and destruction not covered by insurance, rentals and royalties, exploration expenses (including intangible drilling costs and overhead), interest on indebtedness, wages, and similar payments, unrecovered residual value of properties surrendered or abandoned, payments to others for property use, and deductions under other laws (not including those under Law 5421, Article 7, subarticle 1, and Law 5422, Article 1, subarticle 1). Losses sustained may be carried forward for ten years. The most important of these deductions is the depletion allowance. On a percentage basis it amounts to 50% of net income or 27½% of gross, whichever is higher. If taken on a cost basis, the depletion unit is calculated by dividing the value subject to depletion by the number of barrels of reserve. When multiplied by net production during the tax year, the result is the depletion allowance.

The development concessionaire is subject to all normal taxes following deductions listed above. Following recovery by the concessionaire of his investment, a surtax is added which brings total taxation to 50% of net income after payment for normal tax and other direct taxes, rentals, royalties have been subtracted. The result is a 50-50 division of net profits after investment has been recovered.

Any capital imported by the petroleum concessionaire, either during exploration or development, may be repatriated to its country of origin at the exchange rate prevailing at the time of entry. By "capital" is meant actual money brought in, machinery and equipment, intangible rights such as patents, etc., and re-invested profits. Profits may also be repatriated on application.

Political and Other Factors Affecting Investment

Turkey has remained politically stable since the National Pact of 1919 which heralded the arrival of Ataturk, founder of the Turkish Republic. In 1946, the single party system which he began was dissolved when Colal Bayar and other leaders left the Republican Party to form the new Democratic Party which is now in power, having been reinstalled by a landslide election in May 1954, over the other 12 political parties. The attitude of the government toward private capital, both foreign and domestic, has changed from the primarily state economy envisaged by Ataturk to a policy of actively encouraging foreign investment in essential fields, although there remains a fear of foreign exploitation. One positive manifestation of the new policy of investment encouragement is seen in the tax and exchange privileges listed below in this section.

One obstacle to investment lies in the physical character of the country. The total area is 296,500 square miles, slightly larger than Texas. Internal topography is rough and transportation means are inadequate, although the highway network has strongly improved since a nine-year plan was instigated with U. S. aid in 1949. The rail network has expanded somewhat but less rapidly due to high costs. The population of about 23 million (by 1955 census) is engaged primarily in agriculture, which in 1951 contributed 58.1% of national income, and skilled labor is scarce.

The labor movement in Turkey is very young, undeveloped, and peaceful. Labor legislation is largely summarized in the 1936 Labor Code which provides, among other things, a 48-hour week of eight to nine hours daily (which is largely ignored; 10 to 11 hours are often the rule) and no minimum wage. Although employment of foreigners is limited, this is set aside by provision of the special law for new investments. Disability incurred on the job must be compensated up to 52 weeks at 75% salary for persons for dependents with temporary disability, or 60% pension for permanent disability. Medical care and sickness insurance must be paid by the employer. The total cost of labor legislation to the employer is only 12% of the base wage.

Unions cover only a small part of the 8-million-person labor force (of which only 12% is employed in industry and mining). The largest labor confederation is the TCTU (Turkish Confederation of Labor), of which the petroleum union, the Raman-Batman Oil Workers Syndicate is a member. Since unions do not have the right to strike, the labor scene remains peaceful, aided by high employment, although there is serious under-employment in agriculture.

Average wages are low, and although there is little skilled labor available, there is little difference in skilled and non-skilled wage rates. Monthly wages during 1952 ranged from 225 lira ($78) to 1,000 lira ($350) for supervisory personnel; 175 to 750 lira monthly for skilled workers ($62 to $265); and from 110 to 500 lira ($39 to $177) monthly for unskilled workers. These rates are less than half U. S. union scale. In the mining industry during April 1955, the average miner received 4.5 to five liras daily, or about $1.60 to 1.79, with additional "fringe" benefits totaling about 2.5 lira ($0.89) per day in the form of hospitalization, free meals, dormitory, etc.

Substantial benefits have been given new industries as regards foreign exchange. The official unit of currency is the Turkish pound, known as the lira, divisible into 100 kurus. At the official rate, the lira is worth $0.354 and at the unofficial rate (as of March 30, 1955) $0.12. The official rate has been used in conversions given earlier in this report, since this is the rate which entering petroleum companies must use. Ordinarily companies are given the right to export 10% of their invested capital yearly and profits up to 10% of their invested capital. By the new Foreign Investment Encouragement Law of January 18, 1954, however, there is no limitation on the repatriation of capital or profits for new approved investments. The rate used is that prevailing of the foreign currency involved (for example, the dollar) at the time of transfer, or the official rate in the case of capital.

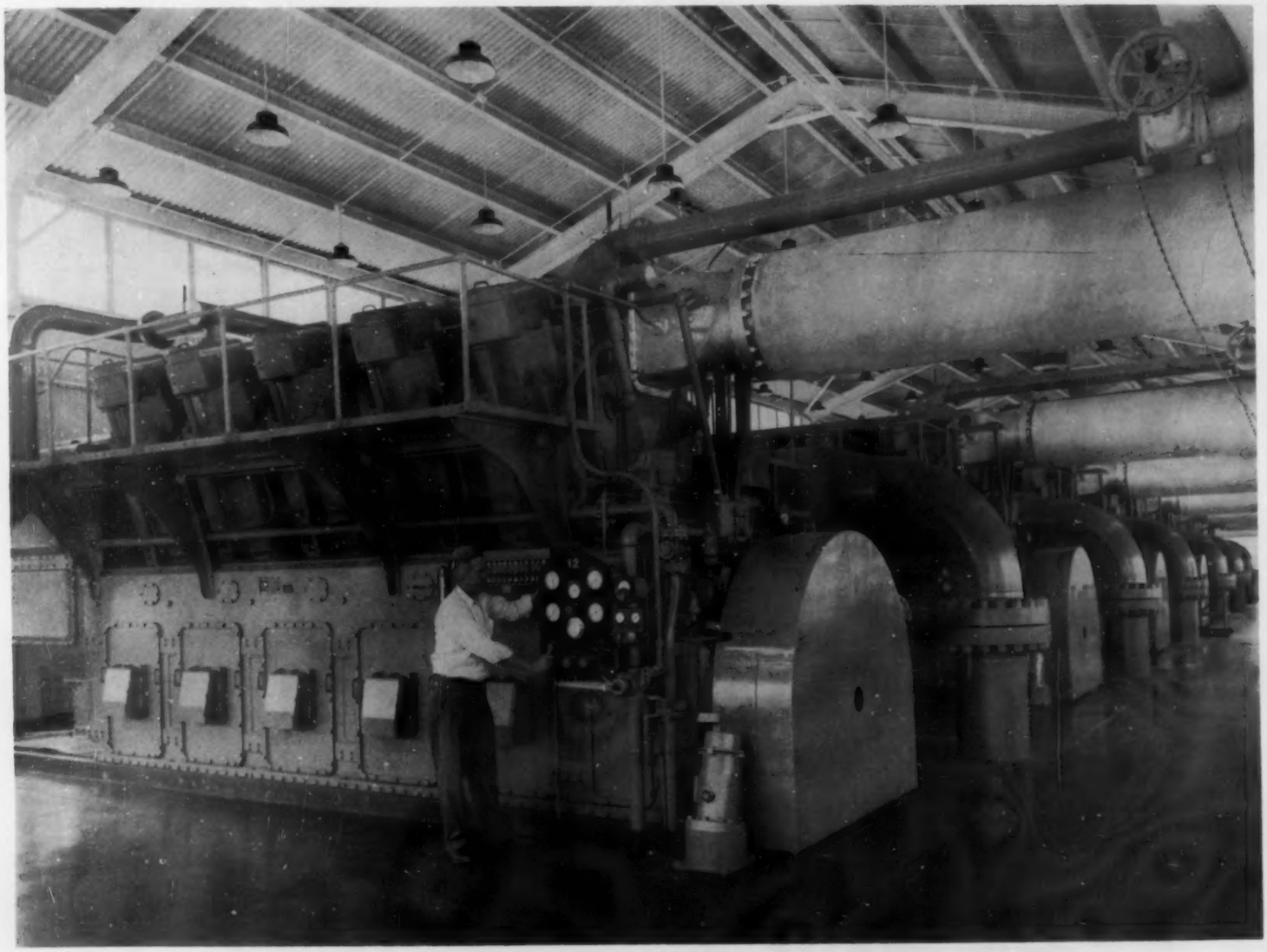
Taxation on corporations, including all "limited by shares," is a flat 10% of net profits, with State-owned enterprises, as well as those owned by associations or trust funds, subject to a flat 35%. The tax is payable on net profits with deductions authorized for losses incurred in past two years. There is no capital, dividend, remittance or general sales tax, nor does a tax treaty for the avoidance of double taxation exist with the United States.

The Turkish economy has been strained by the increase in economic development and in military expenditure and the government has been forced to restrict foreign trade severely. Payment on oil imports are considerably in arrears and now subject to negotiations with the government.

The problem of natural gas supply in a varying and growing East Coast market is being solved by the world's largest underground gas storage reservoir at Oakford, Pennsylvania. Operators are New York State Natural Gas Corporation, supplying customers in New York, Pennsylvania and Ohio, and Texas Eastern Transmission Corporation of Shreveport, Louisiana.

World's Largest Underground Gas Storage Installation

Interior view of the Oakford station. Compressors shown are 2,500 hp Cooper Bessemer, model GMW-10.



View of the central dispatching room at the Oakford station. Valves on meter runs are electrically controlled from inside the dispatching room.

Fenton H. Finn, president of New York State Natural Gas Corporation.

IN the decade which has elapsed since the close of World War II the natural gas industry in the United States has been engaged in an expansion of explosive rapidity.

Long distance transmission lines have been extended to virtually every important consuming center in the country. Backed by strong advertising campaigns the distributors of natural gas in urban centers have been so successful in their load building drive that fuel oil distributors have begun to worry.

At the close of 1955 there were 8.0 million homes heated by natural gas in the United States as compared with 8.2 million with central heating systems using fuel oil.

The heavy home heating load has created a problem for the gas companies because of the very large seasonal factor. In some areas mid-winter demand is as much as 15 times as great as midsummer demand when only the cookstove and hot water heater are in service. This situation has been solved in many areas by the development of underground storage reservoirs permitting storage near market centers and hence limiting the size of transmission lines by leveling out the summer-winter demand curve.

Northeastern states are particularly fortunate since there exist a large number of old gas fields which have been largely depleted during the past 50-odd years.

Pennsylvania alone has underground storage for 400 billion cubic feet of gas. West Virginia is in second place with 260 billion. At the end of 1955 total underground storage capacity was about 1.8 trillion cubic feet and at that time contained 1,368,265 million cubic feet according to estimate of the American Gas Association. During the year 1955 gas companies increased their gas inventory in underground storage by 87.6 billion cubic feet.

An outstanding example of an underground storage installation in consuming territory is the Oakford, Pennsylvania, unit of New York State Natural Gas Corp., a Pittsburgh-based subsidiary of Consolidated Natural Gas Co., New York, and Texas Eastern Transmission Corp. With a capacity of 105 billion cubic feet the Oakford unit is the largest of its kind in the world.

The Oakford plant is basically a flywheel in New York State Natural's extensive distribution system, whose operations have grown extensively since the end of World War II to keep pace with the rising east coast demand for natural gas.

Like other gas distributors, New York State Natural faces wide fluctuations in demand, with peak usage occurring during cold winter days and low points occurring during the summer. The swing is illustrated by New York State Natural's record delivery day record during Dec. 20, 1955, of slightly over one billion cubic feet, compared with sales of about 112 billion for the entire year, an average of about 300 million per day.

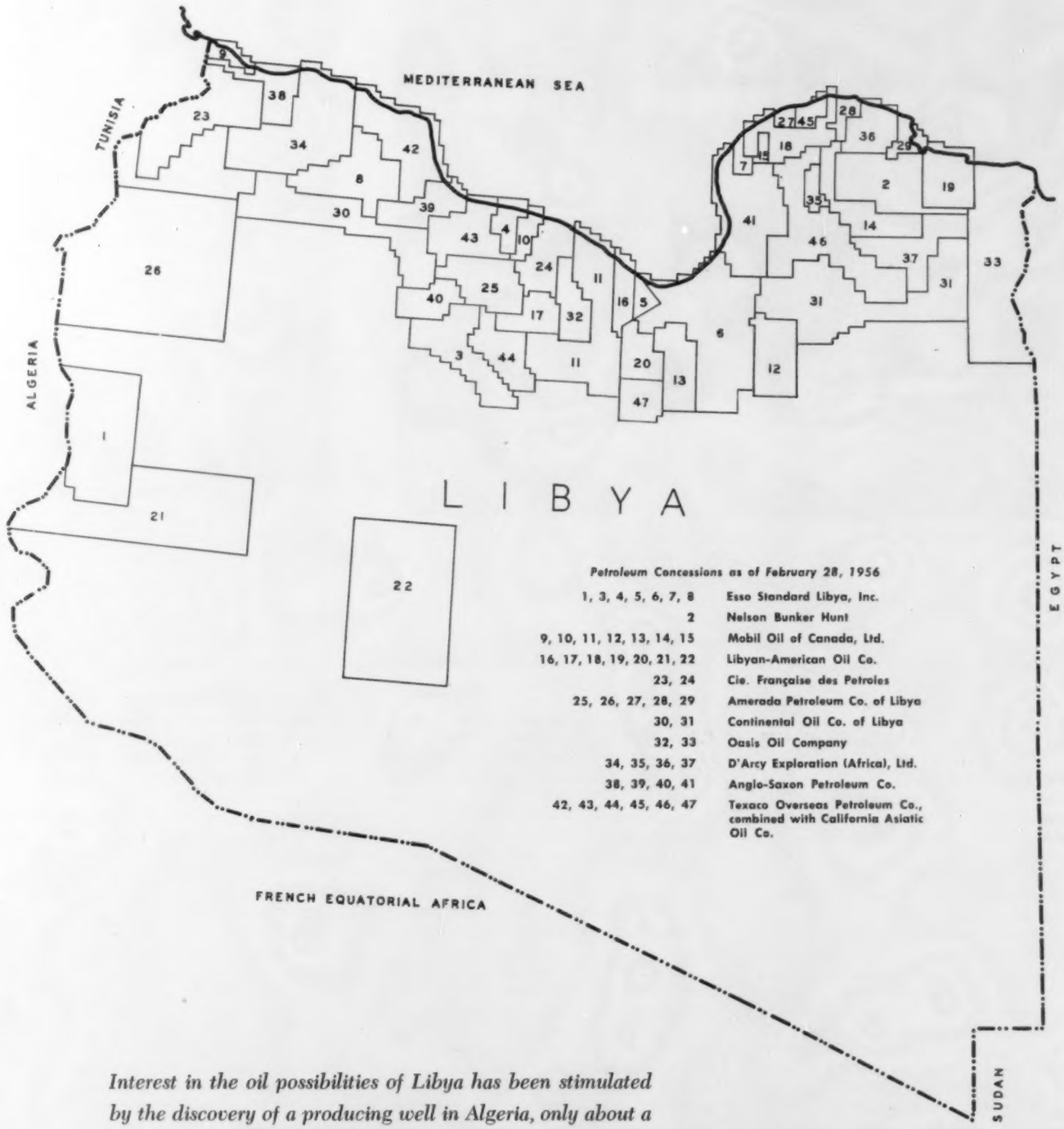
Although the flywheel effect is the main reason for the construction of enormous underground units for storage such as Oakford, there are other considerations as well. One is the considerable saving in pipe line capacity which would have to be built from the supplying fields to consuming centers to supply peak loads. There is a saving involved, too, in the more uniform and therefore more efficient operational rates achieved. Last, but not least, the underground storage enables the wholesaling companies to provide their gas sales without exceeding their contractual requirements with pipeline supplies.

The Oakford installation was New York State Natural's answer to these problems and advantages. It was originally conceived as a steady load facility, operating on a 150-day withdrawal season, from November 1 to April 1 with a total withdrawal of 60 billion cubic feet. The total ultimate volume is 105 billion cubic feet of gas in storage, of which 45 billion is used as "cushion" or base gas.

The Oakford pool is operated by New York State Natural and Texas Eastern. It contemplated an average daily withdrawal rate of 400 million cubic feet, divided equally between the two companies. Peak delivery rates of as high as 460 million cubic feet can be reached for a few days each month, with an emergency peak rate ability of 700 million cubic feet daily. When completed, the two sands used, the Fifth Sand and the Murrysville sand as later described, will have pressure ranges from 1,200 (Fifth Sand) to 400 psig (Murrysville Sand), with storage inventories from 21 to 12 billion cubic feet in the case of the Fifth Sand, and pressures from 450 to 100 psig with storage inventories ranging from 84 to 33 billion cubic feet in the case of the Murrysville Sand. Injection rates as high as 550 million cubic feet daily may be attained in the future.

The old gas field, which forms the reservoir proper, was renovated at a cost of

(*Continued on page* 83)


MEDITERRANEAN SEA
TUNISIA
ALGERIA
EGYPT
SUDAN
FRENCH EQUATORIAL AFRICA
LIBYA
Petroleum Concessions as of February 28, 1956
1, 3, 4, 5, 6, 7, 8 Esso Standard Libya, Inc.
2 Nelson Bunker Hunt
9, 10, 11, 12, 13, 14, 15 Mobil Oil of Canada, Ltd.
16, 17, 18, 19, 20, 21, 22 Libyan-American Oil Co.
23, 24 Cie. Française des Petroles
25, 26, 27, 28, 29 Amerada Petroleum Co. of Libya
30, 31 Continental Oil Co. of Libya
32, 33 Oasis Oil Company
34, 35, 36, 37 D'Arcy Exploration (Africa), Ltd.
38, 39, 40, 41 Anglo-Saxon Petroleum Co.
42, 43, 44, 45, 46, 47 Texaco Overseas Petroleum Co., combined with California Asiatic Oil Co.

Interest in the oil possibilities of Libya has been stimulated by the discovery of a producing well in Algeria, only about a mile from the border of Libya.

In the following article the chairman of Libya's Petroleum Commission, who was instrumental in shaping the new liberal oil law, gives the basic philosophy and terms of that law.

LIBYA's invitation to oil companies

By Mr. Anis Qasem, Chairman of the Petroleum Commission

A Petroleum Law addressed to the world at large is in reality an offer, the acceptability of which depends largely on the merits of the offer itself. The law must contemplate the kind of person it intends to deal with and by that much must make the offer inducive to him. It must recognize its legitimate needs and interests and try to weld them harmoniously within the country's needs and interests in order to create a real community of interests.

It is not by any means easy for a legislator to adopt a dispassionate attitude when such a fiery project is being considered. Nationalism and party politics cannot always be driven to the background when foreign companies are involved. It is partly because of this that the legislator has to exert a special effort to adopt an attitude of mind basically different from its attitude when enacting other laws. It will have to keep the absent partner constantly in mind. The practical way of applying this philosophy was adopted by the Libyan Government when it requested interested oil companies to send their representatives to consider with government representatives a government bill on petroleum. The representatives met on the first of November 1955 and I had the pleasure and the privilege of presiding over the meetings representing the government. By the end of the month an amended draft emerged which, with minor amendments, was passed by the legislature early in 1955.

The Libyan Petroleum Law No. 25, 1955, makes a sincere effort to meet this situation. Time alone will judge how far it has succeeded. It will not be possible within the scope of one article to deal with the provisions of this law in any detail. It will suffice at this stage to give a general outline which, of necessity, will leave much unsaid.

Because of the importance and duration of petroleum concessions many countries submit to their parliaments each and every concession negotiated with any oil company. Without in any way doubting the wisdom of this procedure it must, however, be admitted that it can have a number of practical disadvantages—such as delays not necessarily connected with the merits of the case, and continuous wrangling between government, parliament and company with the not infrequent result of friction.

The same results of parliamentary participation and control can be achieved in a different manner. The Libyan Parliament, in approving the Petroleum Law, approved at the same time, as the First and Second Schedules to the Law, the exact terms of a Standard Reconnaissance Permit and Deed of Concession. Deviation from the text of these two schedules is explicitly prohibited except in the case of minor non-discriminatory variations.

The Libyan Petroleum Law refers to two stages of operations. The first is the preliminary exploration stage for which a Reconnaissance Permit may be obtained. The duration of the permit is one year liable to renewal on payment of the prescribed fee. The permit allows the carrying out of surface geological reconnaissance, aerial surveys and surface geophysical operations commonly used in the petroleum industry. The drilling of exploration wells, mechanical core drilling and seismic operations are not allowed under the permit. Apart from this the issue of the permit does not confer on the holder any rights or privileges with regards to the prospecting or mining for petroleum.

The second stage is the concession stage. The law does not require applicants for concessions to have obtained the permits. However, regulations require the submission of geological informations on which the application for concession is based.

Article 1 declares that all petroleum in Libya in its natural state in strata is the property of the Libyan State, and no person may explore or prospect for, mine or produce petroleum in any part of Libya, unless authorized by a permit or concession issued under the law. From this basic principle stems a number of consequences of far-reaching importance. No land owner may claim any royalties on petroleum that may be discovered in his land. He is considered a surface owner with the right to fair compensation for the loss of use of his land and any other damages suffered by him as a result of the operations.

Secondly, all petroleum affairs are administered by a government agency called the Petroleum Commission which enjoys an autonomous independent status. The establishment of the commission was a constitutional success under a more or less difficult federal constitution. In the hands of this commission, subject to the supervision of the Minister of National Economics, are centralized all the powers regarding petroleum, including the collection of fees, rents, taxes and royalties payable under the law. This method greatly facilitates dealings of the companies with the government and the government control of the activities of the companies.

In order to protect the government and serious companies from speculators and in an attempt to ensure that only serious applicants are accepted, the commission is charged with the duty of accepting only eligible applicants. In determining the eligibility of an applicant the commission takes into consideration the furtherance of the national interest, the previous activities of the applicant in the petroleum industry, his compliance with relevant laws and regulations and his financial and technical capacity. If the applicant is a subsidiary or a member of a group of companies reference may be made to the parent company or the group to determine the eligibility of the applicant. The ruling of the commission regarding the eligibility of an applicant is final in respect of the particular applications. Regulations, however, have provided that such ruling is not necessarily binding on the commission with reference to future applications by the same applicant. Circumstances change and with them may change the qualifications of the applicant.

Applications submitted on the same day have equal priority. Special treatment has been given to first applications. In order to avoid an undignified rush on the day of coming into force of the law it is provided that applications submitted up to midnight of the seventh day following the coming into force of the law shall be considered simultaneous.

To settle conflicting simultaneous applications applicants are first asked to attempt such settlement by mutual agreement. If they fail to agree the commission will mediate between them. If mediation fails the commission is empowered to adopt any objective solution it deems fit, such as dividing the area by lot or requesting the parties to pool the area.

The financial provisions of the law and the concession are very reasonable and, if anything, generous to the companies. The concession holder shall pay such income tax and other taxes and imposts as are payable under the laws of Libya but shall not be subject to any form of taxation or other exaction of such a nature as to render him liable to taxation or other dues not payable by persons in general operating in Libya other than fees, royalties and surface rents made payable under the law. The fee is payable only once on the grant of the concession or permit and is £500 (one Libyan pound equals one pound sterling). The surface rents are negligible, ranging from £5 for each 100 square kilometers ($0.36 per acre) to £2,500 after 15 years ($1.80 per acre) or until petroleum is found in commercial quantities, whichever is the earlier. Rents are abated by royalties when royalties become due.

The cardinal point in the financial arrangement is the 50-50 sharing of net profits after a certain date called the "effective date." The "effective date" means the date on which the concession holder first reaches a level of regular exports of petroleum averaging 15,000 barrels a day measured over a period of 30 consecutive days under all his concessions in Libya or the expiry of four years from the date when petroleum is first exported regularly by the concession holder, whichever is the earlier. Before the effective date the government is entitled to a royalty of 12½% of the value on the field of production of all petroleum (excluding natural gas) won and saved into field storage, and of all natural gasoline recovered from the concession area, after deduction of the quantities of such petroleum, petroleum products and natural gasoline used by the concession holder in the course of his operations under the concession. In calculating net profits various deductions from gross income are allowed, including losses and expenses, an amortization allowance ranging from 20% to 10% depending on the date on which the capital expenditure has been incurred with the concession holder making an annual election, and a depletion allowance irrespective of the amounts so

deducted in any previous years of an amount equal to 25% of the gross income of the year, but limited to 50% of the profits of the year, after deducting expenses, losses and the amortization allowance. Instead of the percentage depletion allowance, a cost depletion allowance is permitted ranging between 20% and 5% per annum. The election is made annually. It is conceivable that these deductions may exceed the gross income in which case a carry over of the excess is allowed for a period not exceeding ten years.

It is worth mentioning that the law does not provide for a minimum royalty after the effective date. After that date it is quite possible that the revenue accruing to the government may become less. This, however, is a part of a deliberate policy. It was thought that, in a relatively unknown country as far as petroleum is concerned, such policy might encourage the companies to develop marginal wells which, under the shadow of a guaranteed royalty, might be left undeveloped. It was also thought that such policy might encourage companies to spread their operations in such a way as to embrace the whole country. Anyhow, the reduction in government income will mostly arise from further exploration by the companies, and the government is interested in seeing exploration work done throughout the entire country.

The working obligations are very generous, and were designed in such a way as to give the operator freedom of action in planning the development of the concession. The obligations, therefore, refer to sums to be expended on work to be done. The concession holder is required to spend an average of £1.5 per square kilometer ($10.80 per square mile) in the first five or eight years depending on the petroleum zone, £3.5 in the next three or four years ($25.20 per square mile) and six pounds ($43.20 per square mile) thereafter during each successive period of five years.

These figures represent less than the minimum that any serious concession holder would actually spend. Carrying over is allowed. No initial bond is required to ensure the execution of these expenditure obligations. However, if the commission finds that a concession holder has seriously neglected his obligations after half of the working obligation period has elapsed, it may require such concession holder to deliver a bond in the amount remaining unspent and if the period elapsed and the expenditure obligations remained unfulfilled the bond will be confiscated in the outstanding sum. Failure to meet the expenditure obligations in two consecutive periods entitles the commission to revoke the concession. The generosity and reasonableness of these provisions cannot be doubted.

It is essential for petroleum operations that the concession area should be of a considerable size. Under the Libyan Petroleum Law the maximum area that may be held by a concession holder is 220,000 square kilometers (84,942 square miles) in the four petroleum zones into which the country is divided. The law empowers the Petroleum Commission to grant concessions in excess of that area should circumstances justify such increase. As regards surrender, a concession holder shall not be required to reduce his area below 3,000 square kilometers (1,158 square miles) in the first and second petroleum zones and 5,000 square kilometers (1,930 square miles) in the third and fourth zones. No doubt these provisions will help a concession holder to operate with great freedom. As to the acquisition of land, if the concession holder fails to agree with the owner or occupier all that he is required to do is to deliver to the commission reasonable compensation and the commission will put him into occupation of the land and will take all legal measures to have the land expropriated or the compensation determined or both as the case may be.

It is of importance to a concession holder that he should not be unduly restricted as to his labor. The Libyan Petroleum Law does not place any undue restrictions. Subject to the Immigration Laws the concession holder is allowed to bring into the country such employees as may be necessary for his operations and the appropriate authorities will facilitate the entry into, exit from and movement within Libya of such employees and their dependents while such employees are engaged on the concession holder's operations. The present Immigration Law excludes from entry criminals and the like. Otherwise it is quite liberal and will not stand in the way of bona fide employees of any concession holder. The only labor requirement is that the minimum number of Libyan subjects employed by a concession holder in Libya after ten years from the date of commencement of operations should have reached at least 75% of the total number of persons employed by him in Libya, provided that the requisite number having adequate skill and ability is available. The concession holder is required from the date of commencement of regular exports of petroleum in commercial quantities to make an annual payment to the government of not less than £2,500 and not more than £5,000 for the training of Libyans to fit them for employment in the petroleum industry or in related undertakings. The concession holder, however, is allowed each year to reduce such payment by the amount which during that year he has expended for the training and education of Libyan subjects for such purpose in Libya or abroad. Judging from past experiences of petroleum operations the petroleum companies will adopt this policy whether provided for by law or not. In this there is a definite community of interest between government and companies.

One point of vital interest to the companies is the freedom of importing their equipment and plant and the exportation of any oil they may discover without being subjected to customs duties and export formalities. This is guaranteed to them by the law and the concession.

The problem of exchange control is dealt with to the satisfaction of the companies. They may import, buy or sell in Libya, at the most favorable rate of exchange, the funds needed for their operations or in order to remit any funds in excess of their requirements in Libya to the country of origin. The companies are further entitled to retain abroad all funds acquired abroad including the proceeds of the sale of Libyan petroleum insofar as such funds may exceed their requirements in Libya. They should, however, inform the National Bank of Libya of their foreign exchange holdings or proceeds of sales of Libyan petroleum.

The duration of the concession is to be fixed by the applicant provided that it should not exceed 50 years and the concession may be renewed for any period provided that its total duration shall not exceed 60 years.

The government and all state agencies guarantee to the concession holder the enjoyment of his rights under the concession and no regulation or alteration thereof may affect adversely the contractual rights expressly granted under any exploration permit or concession in existence at the time the regulation is made or altered. The contractual rights created by the concession are not to be altered except by mutual consent of the parties, and the concession may be revoked only in the circumstances and in the manner set out in the concession. Disputes between the parties are to be settled by arbitration unless resolved by other means. The procedure adopted is in the line generally prevailing in the Middle East with the president of the International Court of Justice appointing the umpire or sole arbitrator if the parties fail to agree. In settling the dispute the umpire or sole arbitrator shall apply Libyan Law, and relevant rules and principles of International Law. The results of arbitration are final and binding on both parties and they shall share costs of arbitration in the manner determined therein.

Within the first seven days of the coming into force of the Law, 54 applications for concessions were filed with the commission. With the exception of one application all of them overlapsed in certain areas. The commission, after careful study, decided that all applicants, with the exception of one group, were eligible and, accordingly, gave the eligible applicants 30 days to settle their overlaps and most of the overlapping areas was settled in that way. On Nov. 13, 1955, the commission announced its decision approving the settlement and settling the remaining conflicts. When formalities were completed 47 concessions were granted.

Libya will be the scene of intensive activity and the presence of many competing companies will undoubtedly intensify the search in this virgin territory. Some companies will start exploratory drilling almost immediately and others will follow suit as soon as their preliminary surveys are completed. The commission and all the government agencies are doing all that they can to facilitate their operations. We wish them good luck.

PROTECTION

SCHLUMBERGER
THE OIL MAN'S
PROTECTION.

GEWERKSCHAFT ERDÖL-RAFFINERIE EMSLAND, GERMANY

The Houdriflow catalytic cracker of the Gewerkschaft Erdöl-Raffinerie Emsland, at Lingen, Germany, is the principal unit in a completely new refinery. This 17,500 BPSD cracker went on stream in the Fall of 1953.

The Emsland Houdriflow cracks straight run and coker gas oils and, in addition, desulphurizes the straight run and coker gasoline simultaneously. The refinery is currently processing a mixture of Georgsdorf and Emlichheim crudes. A unique processing scheme is employed at this refinery. No crude distillation unit exists; the Houdriflow feed stock comprises all flashed straight run materials from the crude as well as total coker effluent—gas, gasoline and gas oil. This integrated arrangement eliminates intermediate storage, thereby reducing operating and equipment costs.

A new brochure describing the Houdriflow process is available on request. Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pa.

HOUDRY

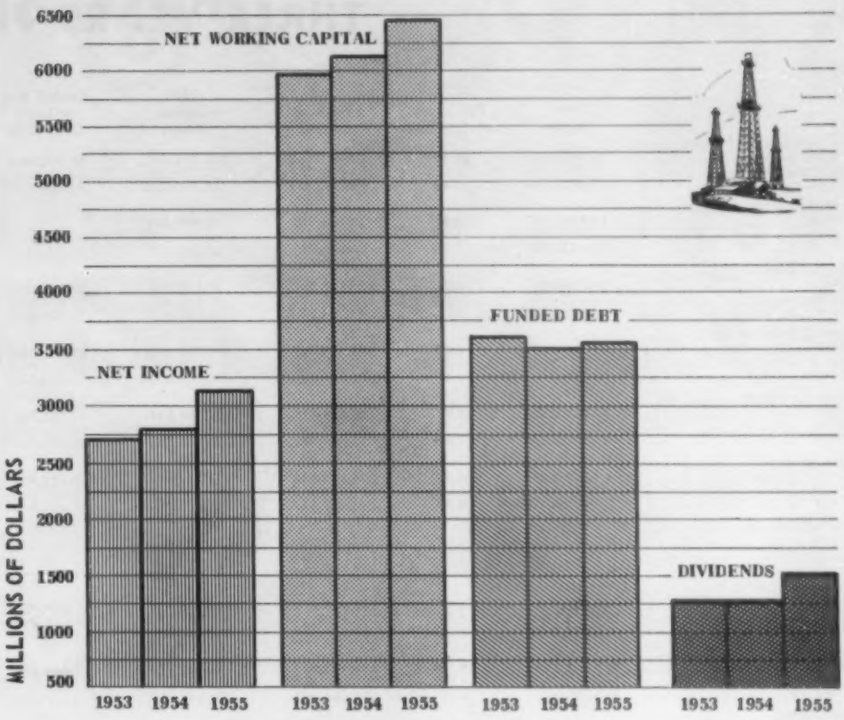
PROCESS CORPORATION

Pioneer in Catalytic Processes

FIRST QUARTER NET INCOME
(Thousands of Dollars)

Company	Net Income 1955	Net Income 1954	Per Share of Common 1955	Per Share of Common 1954
Anderson Prichard	$ 1,353	$ 611	$ .83	$ .38
Amerada	7,623	6,400	1.21	1.01
Atlantic	12,223	9,821	1.32	1.06
Bishop Oil Co.	119	69	.22	.13
Cities Service	18,180	14,075	1.80	1.42
Continental	13,794	12,142	1.41	1.25
Creole Pet.	83,443	75,944	1.08	.98
Gulf Oil Corp.	69,319	45,320	2.47	1.61
Honolulu Oil	3,739	3,202	1.00	.85
Houston Oil, Texas	2,166	2,072	1.59	1.54
Imperial Oil	19,212	12,893	.64	.43
Middle States	325	345	....	....
Ohio Oil	11,771	10,379	.90	.79
Panhandle Oil	287	211	.18	.13
Phillips Pet.	28,332	22,110	1.65	1.50
Plymouth	2,283	2,204	.94	.91
Pure Oil	9,184	9,429	1.07	1.05
Quaker State	526	602	.64	.73
Richfield	7,512	7,141	1.88	1.79
Seaboard Oil	2,012	1,689	.55	.46
Shell Oil	35,010	28,585	1.27	1.04
Sinclair Oil	24,246	21,208	1.68	1.68
Skelly Oil	8,033	7,698	1.39	1.33
Socony Mobil	62,000	52,000	1.77	1.48
Standard of Calif.	61,494	53,131	1.95	1.68
Standard of Ind.	41,378	34,951	1.23	1.08
Standard of Ken.	74,739	69,431	1.15	1.10
Standard of N.J.	205,000	177,000	1.04	.90
Standard of Ohio	6,517	6,080	1.57	1.46
Sun Oil Co.	12,255	11,722	1.21	1.21
Superior Oil, Calif.	22,379	20,209	2.69*	6.13
Sunray-Midcontinent	11,300	8,500	.64	.51
The Texas Co.	69,958	56,021	2.55	2.04
Texas Gulf Prod.	1,797	1,855	.49	.51
Tidewater Oil**	9,037	8,083	.72	.67
Union Oil of Calif.	7,030	7,107	.96	.94
Wilcox Oil	2,711	1,971	1.06	.80
Total	**$948,227**	**$802,211**		

*422,264 shares. **formerly Tide Water Assoc. Oil.



Comparison of net working capital, funded debt, net income, and dividends paid by oil companies in the past three years.

Oil Company Earnings 16.6% Higher in 1955

NET income of 42 oil companies increased 16.6% in 1955 to $3,230 million. In the previous year the 42 companies had earned $2,771 million after all charges.

The industry paid 44.4% of its earnings to stockholders in 1955 compared with 46.6% in 1954. Common and preferred dividend payments totaled $1,533 million. Earnings retained in the business for expansion totaled $1,697 million.

The 42 companies covered in this report made capital investments totaling $4,000 million in 1955 in order to supply the rapidly growing demand for oil. Funded and other long term debt increased only $46.4 million to $3,545 million at the end of the year, new capital being supplied from retained earnings and reserves for depreciation and depletion.

The 42 companies increased their net working capital $376 million or 6.1% in 1955 to $6,477 million. Growth characteristics of the industry were revealed in the continued rise in net capital assets. Increase in 1955 was 8.4% or $1,516 million to $19,574 million.

The upward trend in earnings is continuing in 1956 as will be seen in an accompanying tabulation of first quarter reports of companies.

Of the 42 companies for which significant 1955 figures are tabulated on succeeding pages, only six reported lower earnings than in 1954. Proportionate declines in earnings were largest in the cases of Superior Oil Co. and Middle States Petroleum Co. Superior earnings of $3,395,000 or $8.04 per share compare with $10,360,388 or $24.54 per share in 1954. Middle States 1955 earnings of $1,006,718 or 42 cents per share compared with $1,648,437 or 68 cents per share the previous year. Atlantic Refining Co. earnings were off about 5%, Getty Oil 10%, Panhandle 5% and Union Oil of Calif. 14%.

Among the largest gainers in net income among the 36 which had higher earnings were Ashland, Humble, Phillips, California, Indiana and Jersey Standards, Gulf, Imperial, Socony, Texaco and Wilcox.

Ashland Oil and Refining Co. earned $10.1 million or 1.56 per share compared with $6.6 million or 92 cents per share in 1954.

Gulf Oil Corp. earnings rose $35 million to $218 million or $8.19 per share from $183 million or 6.87 per share in 1954.

Phillips Petroleum Co. reported an increase of $19 million in net profit to $195 million or $5.55 per share compared with $76 million or $5.20 per share in 1954.

Standard Oil Co. (N.J.) earned $10.84 per share in 1955 compared with $9.56 per share in 1954 and the rapid upward trend has continued through the first quarter of 1956. Jersey earnings totaled $709 million last year and $584 million in 1954. Jersey's Canadian affiliate Imperial Oil Ltd. began to cash in last year on its large expenditures in recent years. Earnings were up about 25% to $62 million or $2.08 per share. Creole in Venezuela increased its net $53 million to $292 million or $3.78 per share. Humble had a rise of nearly 20% in earnings to $175 million or $4.88 per share compared with $146 million or $4.08 per share the previous year.

Socony Mobil Oil Co. increased its profit $24 million last year to $207 million or $5.93 per share. In 1954 earnings totaled $184 million.

Wilcox Oil Co. earnings rose about 50% in 1956 to $3.48 per share and topped the 1953 record of $3.30 per share.

As will be observed from the table on the succeeding pages, many other companies reported very large increase in earnings. Continent net was up $5 million, Honolulu $3 million, Ohio Oil $3 million, Pure $4 million, Richfield $9 million, Shell $4 million, Sinclair $6 million, Skelly $3 million, Standard of California $20 million, Standard of Indiana $40 million, Standard of Ohio $5 million, Sun $8 million, The Texas Co. $36 million and Tidewater $3 million.

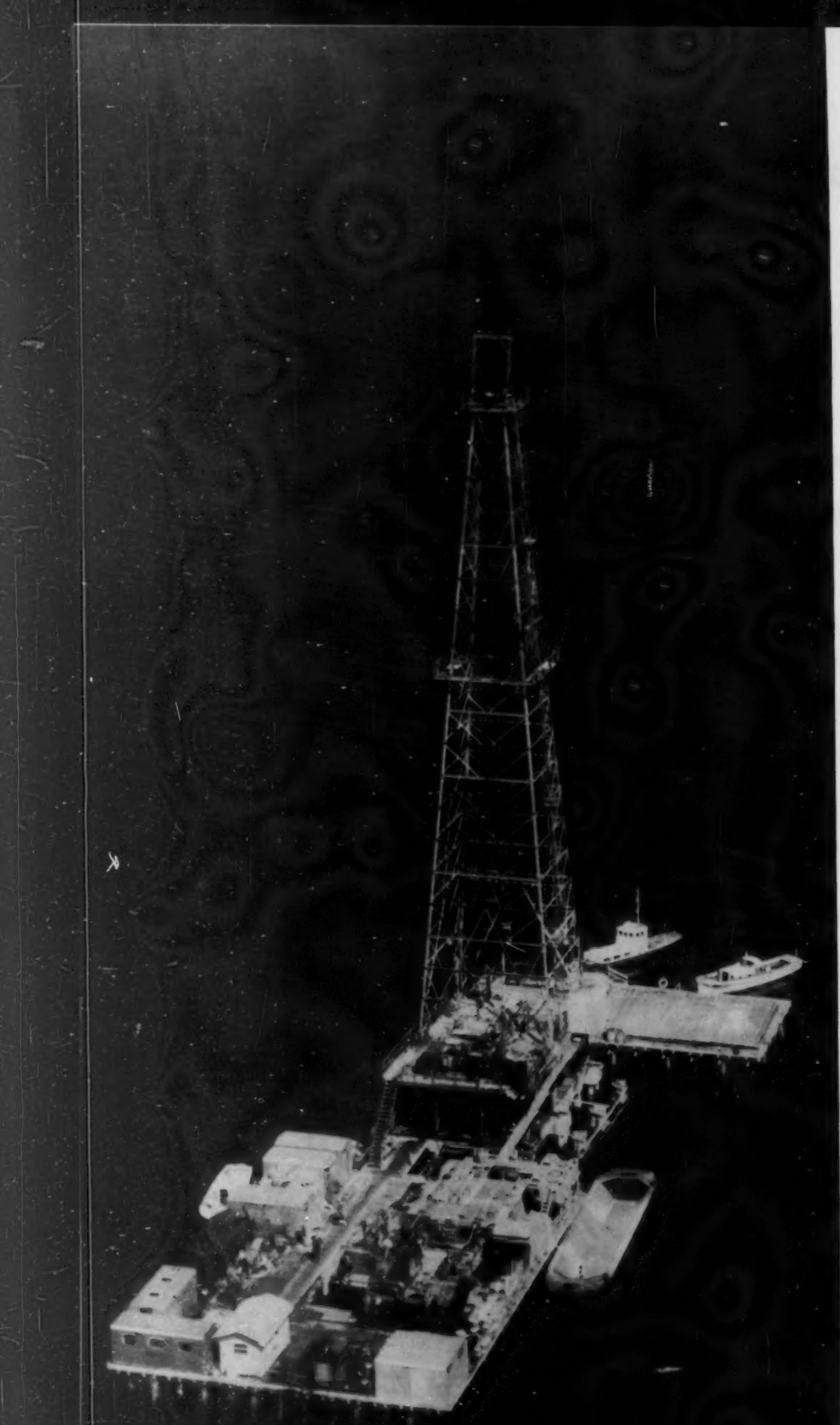
THREE YEARS FINANCIAL REVIEW OF

	Net Income	Per Share of Common	Net Working Capital	Net Capital Assets	Funded and or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
Anderson Prichard								
1955	**$4,965,200**	**$6.10**	**$5,481,562**	**$42,775,832**	**$9,900,000**	.....	**$813,433**	**$31,792,750**
1954	3,253,561	4.00	6,128,711	39,972,089	10,500,000	.....	813,433	28,454,406
1953	4,441,574	5.46	8,140,693	36,820,232	11,100,000	.....	813,433	26,502,331
Amerada Corp.								
1955	**25,363,673**	**4.02**	**49,542,789**	**73,317,682**	.....	.....	**6,309,400(A1)**	**104,139,907**
1954	19,777,648	3.13(A)	36,778,125	68,485,369	.....	.....	3,154,700	89,817,684
1953	18,445,590	5.85	29,806,707	60,853,614	.....	.....	3,154,700	79,504,136
Ashland Oil								
1955	**10,106,032**	**1.56**	**49,520,893**	**70,132,006**	**29,717,000**	**774,512(B)**	**5,427,383(B)**	**61,541,609**
1954	6,628,076	.92	45,686,614	73,014,850	31,697,000	819,281	5,426,507	56,467,525
1953	8,407,616	1.26	45,071,254	76,307,671	33,521,000	779,056	5,396,609	57,137,161
Atlantic Refining Co.								
1955	**39,464,000**	**4.25**	**93,493,000**	**413,152,000**	**83,400,000**	**352,000(C)**	**8,965,774(C1)**	**313,630,437**
1954	41,351,000	4.47(B1)	93,384,000	407,821,000	82,700,000	352,000(C)	8,962,177	306,902,973
1953	49,755,000	5.41	36,786,000	390,764,000	32,023,000	352,000(C)	8,961,977	284,758,547
British American								
1955	**20,613,000**	**2.27**	**60,636,633**	**155,701,327**	**41,583,780**	.....	**9,099,999(C)**	**181,881,034**
1954	18,159,000	2.16	58,276,550	144,882,921	57,778,500	.....	8,412,363(C)	152,710,636
1953	19,735,000	2.40	35,989,417	136,578,123	42,530,200	.....	8,208,118(C)	136,262,220
Cities Service								
1955	**46,358,772**	**4.75**	**306,809,242**	**636,632,938**	**390,622,971**	.....	**10,110,347(D)**	**442,510,469**
1954	41,683,189	4.28	315,278,048	606,535,116	396,067,025	.....	3,964,842	475,474,423
1953	40,874,666	4.20	266,257,577	701,675,936	461,485,673	.....	3,964,842	435,290,103
Creole Petroleum								
1955	292,943,913	3.78	197,158,239	585,655,899	.....	.....	**77,595,930(E)**	**756,597,591**
1954	239,650,741	3.09(D1)	216,630,266	573,867,150	.....	.....	25,865,310	739,119,229
1953	228,997,006	2.95(D1)	191,736,106	550,948,031	.....	.....	25,865,310	439,131,763
Continental Oil								
1955	**46,358,772**	**4.75**	**106,006,070**	**290,350,663**	**107,544,850**	.....	**9,756,466(D)**	**280,400,181**
1954	41,683,189	4.28	116,205,016	269,243,027	108,133,233	.....	9,746,916	261,335,498
1953	40,874,666	4.20	68,199,014	246,655,660	53,384,259	.....	9,736,916	244,802,917
Gulf Oil Corp.								
1955	**218,064,000**	**8.19**	**429,525,507**	**1,147,973,174**	**175,460,998**	.....	**26,628,067(F)**	**862,763,310**
1954	182,813,000	6.87	391,635,961	1,069,264,316	182,506,361	.....	25,533,768	725,998,653
1953	175,036,000	6.57	424,644,000	890,538,173	178,509,631	.....	24,541,943	565,024,141
Honolulu Oil								
1955	**13,699,000**	**3.65**	**11,301,068**	**57,100,348**	**1,815,938**	.....	**3,750,972(A1)**	**30,298,968**
1954	10,236,000	5.46	12,945,395	47,836,457	2,222,368	.....	1,875,486	40,981,022
1953	10,172,000	5.42	14,731,462	41,490,641	2,637,887	.....	1,875,486	35,433,427
Houston Oil Co. of Texas								
1955	**6,808,489**	**5.01**	**8,841,569**	**74,914,898**	**22,534,000**	.....	**1,361,600(F1)**	**32,652,333**
1954	6,487,785	4.83	6,825,543	69,767,104	19,917,000	.....	1,343,600	28,432,680
1953	6,709,844	4.58	6,107,610	66,835,840	19,192,000	.....	1,329,600	24,602,195
Humble Oil & Ref.								
1955	**174,997,500**	**4.88**	**78,133,959**	**1,092,523,903**	**23,282,042**	.....	**38,000,000(C)**	**696,238,780**
1954	146,302,700	4.08	99,658,471	981,824,052	19,918,108	.....	36,000,000(C)	604,068,565
1953	164,528,000	4.58	126,566,000	915,822,106	44,346,869	.....	36,000,000(C)	539,474,805
Imperial Oil								
1955	**62,145,140**	**2.08**	**207,612,418**	**372,519,508**	**96,628,338**	.....	**29,865,691(C1-C)**	**302,530,336**
1954	49,582,585	1.66	157,777,865	331,923,590	48,986,227	.....	29,851,276(C)	268,273,632
1953	47,984,515	1.60	166,168,365	291,904,708	50,919,199	.....	29,847,227(C)	235,254,263
Louisiana Land & Exploration Co.								
1955	**13,438,505**	**4.51**	**6,454,515**	**13,595,120**	.....	.....	**2,981,216(G)**	**17,233,548**
1954	12,929,567	4.34	5,957,541	11,550,386	.....	.....	2,979,156	14,710,652
1953	10,602,359	3.56	5,477,117	10,184,577	.....	.....	2,977,306	12,860,939
Mid Continent Oil Co.								
(L2)1955	.....	.....	.....	.....	.....	.....	.....	.....
(L3)1954	13,468,497	7.21	65,995,221	94,658,330	.....	.....	1,868,152	140,619,841
(L3)1953	14,394,239	7.75	63,448,878	90,522,973	.....	.....	1,857,912	134,038,463
Middle States Pet.								
1955	**1,006,718**	**.42**	**4,438,711**	**28,184,964**	**11,200,000**	.....	**2,409,058**	**11,466,424**
1954	1,648,437	.68	2,541,835	28,687,442	12,050,000	.....	2,316,519	10,552,245
1953	2,550,271	1.10	4,522,391	31,113,347	14,434,299	.....	2,316,519	15,476,820
Ohio Oil								
1955	**41,255,462**	**3.14**	**76,889,823**	**219,729,223**	.....	.....	**13,126,753(A1)**	**216,585,714**
1954	38,223,725(H)	2.91	68,591,622	208,318,117	.....	.....	6,563,377	195,676,719
1953	43,579,000	6.63	64,117,355	192,257,461	.....	.....	6,563,377	177,143,123
Getty Oil Co.								
1955	**11,182,071**	**1.94**	**20,371,570**	**46,704,483**	**38,693,110**	**1,285,807**	**5,498,876(J1)**	**62,489,188**
1954	12,517,813	2.18(J)	20,718,747	45,261,318	41,402,795	1,285,807	5,237,030	52,868,824
1953	11,672,586	2.03(J)	15,998,148	29,564,089	38,996,199	1,288,207	4,987,647	41,860,083
Panhandle Oil								
1955	**902,053**	**.57**	**3,315,815**	**10,880,940**	**2,910,333**	.....	**1,592,970**	**9,944,379**
1954	959,974	.60	3,154,775	10,908,458	3,000,000	.....	1,592,970	9,520,104(K)
1953	1,064,631	.67	2,333,437	10,985,528	2,765,977	.....	1,592,970	10,631,104(K)
Phillips Petroleum								
1955	**95,203,057**	**5.55**	**138,838,021**	**879,029,751**	**118,945,583**	.....	**17,142,787(KT)**	**443,872,017**
1954	76,234,679	5.20	150,689,347	799,360,230	265,317,007	.....	14,653,120	395,701,757
1953	76,720,231	5.25	151,467,834	755,460,600	261,552,533	.....	14,613,520	357,533,907
Plymouth Oil								
1955	**6,888,000**	**2.83**	**19,285,864**	**51,748,007**	**19,609,103**	.....	**2,438,399(L)**	**74,709,963**
1954	6,759,000	2.78	19,706,063	49,226,641	19,269,103	.....	2,432,559	31,958,995
1953	8,059,000	3.32	19,537,000	47,268,731	19,029,103	.....	2,432,489	29,956,007
Pure Oil Co.								
1955	**35,164,226**	**4.05**	**96,019,234**	**298,661,239**	**79,582,207**	.....(L1)	**8,549,332(L1)**	**240,205,578**
1954	31,163,000	3.56(A)	89,078,649	267,134,702	31,203,136	442,434	8,137,290(A)	220,136,681
1953	27,104,723	6.17	83,451,938	251,236,439	25,631,113	442,434	4,067,596	203,386,195
Quaker State Oil								
1955	**2,676,256**	**3.24**	**9,118,175**	**13,160,929**	**750,000**	.....	**927,305**	**16,985,982**
1954	2,112,794	2.56	8,058,214	14,216,915	1,250,000	.....	927,305	15,959,726
1953	2,096,424	2.27	9,301,438	14,638,311	.....	.....	927,305	24,574,922(K)
Richfield Oil Co.								
1955	**29,609,669**	**7.40**	**73,175,594**	**192,329,432**	**81,000,000**	.....	**4,000,000**	**121,910,135**
1954	20,240,979	6.39	76,511,916	179,523,089	84,000,000	.....	4,000,000	106,300,687
1953	23,783,304	7.22	62,032,740	165,645,132	71,000,000	.....	4,000,000	89,179,986
Seaboard Oil Co.								
1955	**7,542,000**	**2.06**	**10,600,000**	**42,412,530**	.....	.....	**3,733,149**	**49,800,074**
1954	7,470,307	2.04	14,345,811	35,502,405	.....	.....	3,733,149(M)	45,905,141
1953	6,540,000	1.79	10,525,847	34,103,396	.....	.....	1,244,383	24,933,272

UNITED STATES OIL COMPANIES

	Net Income	Per Share of Common	Net Working Capital	Net Capital Assets	Funded and or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
Shell Oil Co.								
1955	**125,532,000**	**4.56**	**231,254,701**	**728,516,144**	**201,457,000**	.....	**27,533,076(M1)**	**576,662,915**
1954	121,127,000	4.41	178,580,115	642,256,372	137,118,000	.....	27,480,076(A1)	505,171,454
1953	115,407,000	4.20(N)	191,695,000	565,368,984	143,205,000	.....	13,470,038	435,570,051
Signal Oil & Gas								
1955	**9,640,400**	**2.46**	**14,433,012**	**68,104,396**	**7,547,151**	.....	**3,916,004(N1)**	**66,701,102**
1954	9,313,280	2.38	9,665,642	64,791,878	6,687,980	.....	3,737,255	60,261,633
1953	9,266,196	2.47	13,308,496	46,172,647	.....	.....	3,560,155(O)	53,688,260
Sinclair Oil Corp.								
1955	**80,709,954**	**6.01**	**231,714,070**	**812,893,649**	**248,676,951**	.....	**14,528,428(C1)**	**761,131,601**
1954	74,623,256	6.05	244,419,927	762,425,552	323,186,174	.....	13,042,038	640,552,115
1953	68,061,006	5.55	239,478,470	720,101,284	334,548,850	.....	12,997,750	579,460,542
Skelly Oil Co.								
1955	**32,240,262**	**5.61**	**49,923,625**	**232,029,953**	**8,485,000**	.....	**5,746,117**	**131,299,803**
1954	29,455,250	5.12	44,422,994	216,654,592	8,818,000	.....	5,745,117(A1)	109,402,539
1953	31,276,785	5.44	42,495,715	201,828,604	10,535,000	.....	2,873,059	89,715,533
Socony Mobil Oil Co.								
1955	**207,434,017**	**5.93**	**474,321,017**	**1,212,721,491**	**163,575,000**	.....	**35,512,203(C)**	**1,316,977,173**
1954	183,805,995	5.25	422,709,333	1,172,284,093	165,075,000	.....	35,512,203(C)	1,206,998,326
1953	187,250,228	5.35	477,734,711	1,069,330,985	166,075,000	.....	35,512,203(C)	1,091,901,984
Standard of Calif.								
1955	**231,138,655**	**7.31**	**283,228,000**	**1,270,319,631**	**78,562,217**	.....	**31,612,193(PC)**	**1,032,068,809**
1954	211,872,447	6.70	282,223,635	1,137,855,779	78,486,824	.....	30,106,851(C)	1,010,067,482
1953	189,453,450	5.99	273,239,698	1,037,659,406	79,411,503	.....	28,673,192(C)	903,180,268
Standard of Indiana								
1955	**157,120,000**	**4.81**	**478,711,532**	**1,554,905,062**	**391,210,108**	.....	**33,057,113(P-C)**	**919,596,481**
1954	117,160,000	3.73	409,589,671	1,501,830,824	401,039,195	.....	32,467,190(C)	762,478,653
1953	124,830,000	4.06	407,470,000	1,325,447,017	354,733,943	.....	15,386,519(C)	1,052,244,389
Standard of Kentucky								
1955	**12,667,299**	**4.86**	**24,880,664**	**50,767,895**	.....	.....	**2,606,984**	**36,397,149**
1954	12,385,412	4.75	23,638,689	47,804,871	.....	.....	2,606,984	50,193,418
1953	10,441,246	4.01	21,688,063	45,397,966	.....	.....	2,606,984	44,622,376
Standard of N. J.								
1955	**709,310,000**	**10.84**	**1,642,457,000**	**3,872,998,000**	**557,924,000**	.....	**65,435,000**	**2,378,388,578**
1954	584,793,000	9.56	1,522,006,000	3,474,892,000	496,805,000	.....	65,435,000	2,203,121,263
1953	581,008,000	9.59(Q)	1,446,060,000	3,019,828,000	531,749,000	.....	60,571,000	2,220,974,394
Standard Oil of Ohio								
1955	**23,008,463**	**5.53**	**63,497,014**	**194,219,645**	**31,000,000**	**221,314(R)**	**4,020,112(R)**	**171,250,067**
1954	18,527,085	4.41	69,330,328	178,509,626	22,856,580	220,806	4,019,762	158,689,696
1953	21,217,675	5.08	71,552,678	169,770,967	34,641,552	226,178	4,019,484	150,611,637
Sun Oil Co.								
1955	**48,307,360**	**4.72**	**78,055,684**	**370,655,502**	**9,863,150**	.....(R1)	**10,236,433(R1)**	**87,530,079**
1954	40,343,791	4.17	81,074,095	342,245,561	11,832,400	93,197	9,661,720(S)	90,857,669
1953	45,153,602	5.85	78,080,151	320,066,168	19,243,750	93,197	7,729,515	58,587,213
Superior of Calif.								
1955	**3,395,000**	**8.04**	**30,411,232**	**116,483,099**	**49,654,234**	.....	**422,264**	**94,761,314**
1954	10,360,388	24.54	22,531,656	99,759,895	27,552,783	.....	425,014(C)	92,632,000
1953	12,000,381	28.37	22,381,157	93,449,582	29,638,187	.....	425,014(C)	83,605,000
Sunray-Midcontinent								
1955	**(S1) 39,471,783**	**2.27**	**84,288,907**	**337,485,528**	**60,345,667**	**2,816,898(S1)**	**16,439,197(S1)**	**279,036,365**
1954	(S1) 36,728,636	2.23(S1)	117,034,018	325,104,045	76,733,333	1,164,816(C)	12,363,450	316,350,897
1953	(S1) 43,967,066	2.67(S1)	108,445,522	320,993,960	78,520,000	1,249,309(C)	12,137,886	296,417,241
The Texas Co.								
1955	**262,729,738**	**9.27**	**538,658,293**	**1,215,969,460**	**208,968,985**	.....	**27,625,248(T)**	**983,645,810**
1954	226,140,761	8.24	474,193,629	1,137,478,374	214,903,949	.....	27,595,248	837,540,696
1953	192,600,078	7.01	484,710,549	1,018,238,080	219,527,543	.....	27,595,248	714,371,173
Texas Gulf Producing								
1955	**6,320,029**	**1.72**	**8,337,985**	**29,450,148**	**7,050,000**	.....	**3,670,191(U)**	**17,337,769**
1954	5,245,527	1.43(T1)	7,003,131	25,515,824	5,650,000	.....	1,222,297	13,632,794
1953	4,230,659	1.15(T1)	3,535,640	20,948,599	3,600,000	.....	1,218,130	10,281,334
Tidewater Oil Co.								
1955	**37,789,769**	**3.03**	**90,001,630**	**318,047,113**	**50,000,000**	**62,392,700**	**11,484,471(U1-G)**	**201,528,195**
1954	34,547,239	3.13	94,502,763	229,957,767	.....	62,392,700(V)	10,937,591(C)	172,202,075
1953	36,951,568	2.89	88,010,656	207,633,755	.....	.....	12,793,618(C)	184,948,219
Union Oil Co. of California								
1955	**30,522,963**	**4.13**	**88,304,805**	**379,741,538**	**135,782,286**	.....(V1)	**7,331,790(V1)**	**170,489,972**
1954	35,887,920(W)	4.78(W)	80,250,321	358,836,922	93,996,735	232,500	6,658,864	173,419,329
1953	38,099,602(W)	5.08(W)	93,154,778	322,683,906	122,111,274	384,500	5,809,397	125,837,453
Wilcox Oil Co.								
1955	**981,994**	**3.48**	**2,052,197**	**5,958,452**	.....	.....	**281,835(W1)**	**6,662,155**
1954	647,516	2.30	1,938,948	5,582,685	200,000	.....	280,772	5,771,681
1953	928,416	3.30	1,640,278	5,628,339	370,000	.....	280,772	5,557,079

A. Restated to reflect the 2 for 1 stock split.
A1. Stock split 2 for 1.
B. Preferred shares retired as provided in Sinking Fund Provision. Common shares increased as provided in change over of preferred stock to common stock on a 1.5 share basis.
B1. Restated to reflect the 2 for 1 stock split on May 7, 1952.
C. Issued Stock.
C1. Common shares increased because of provision in Incentive Stock Option Plan.
D. 2½ for 1 stock split. 198,242 share increase in common shares provided by stock dividend declared in 11/55.
D1. Restated for 3 for 1 stock split made in 1955.
E. Outstanding and issued shares. 3 for 1 stock split in 1955.
E1. Option for 9,500 shares was exercised in 1955.
F. 70,404 shares of capital stock sold to option holders. 1,023,845 shares assigned.
G. Common shares increased because of provision in Restricted Stock Option Plan.
H. Based on 13,826,753 shares outstanding at 12/31/53.
J. Restated on the basis of 5,498,764 shares outstanding.
J1. 261,846 shares distributed.
K. Includes common stock.
K1. Common shares increased because of Key Executive Employees Stock Option plan which was exercised and because of 3.7% Sinking Fund Debentures.
L. 5,840 shares of option stock exercised.
L1. 442,434 shares of 5% series issued retired in 1955.
L2. Merged with Sunray on May 16, 1955.
L3. Figures for 1954 and 1953 included in Sunray-Midcontinent figures for the same years.
M. 3 for 1 stock split.
M1. Common shares increased 53,000 shares in exchange for the balance (50%) of the outstanding stock of Shell American Petroleum Co.
N. Restated on basis of 27,480,076 shares of common outstanding 12/31/54.
N1. As of 12/10/55, the company made a pro rata distribution of 185,449 shares of Class A capital stock as a 5% dividend to the holders of Class A and B capital stock.
O. 3 for 1 stock split on Class A stock.
O1. Company increased common shares by 1,486,390.
P. 1,505,342 increase in common shares as a result of stock dividend at the rate of one share for each 20 shares.
P1. An increase of 589,925 common shares was the result of the following: 142,548 shares provided under Savings & Stock Bonus Plan, 14,578 shares sold to trustee under new Employee Savings Plan, and 432,799 shares issued in conversion of 30-3-½% Debentures.
Q. Restated on basis of 65,435,000 shares of common outstanding on 12/31/54.
R. 483 shares of common stock issuable for script certificate outstanding and 275 shares were issued upon exercise of options granted under stock option plan.
R1. Class A preferred stock (93197) shares called 12/20/55 for redemption in 1956. 574,713 shares of common stock distributed to stock holders increasing common stock.
S. 5 for 4 stock split.
S1. Mid-Continent merged with Sunray Oil Co. on May 16, 1955. Figures for 1954 and 1953 include Mid-Continent Co. figures for these years. Per share of common figures restated on basis of shares outstanding Dec. 31, 1955. Common and preferred shares increased due to merger.
T. Stock increased because of company's Incentive Compensation Plan.
T1. Restated on 3,670,191 shares of outstanding stock 12/31/55.
U. 3,300 shares of common stock were issued under the 1947 Stock Option Plan.
U1. 546,880 shares of common stock issued as dividends.
V. Exchange for an equal number of shares of common stock.
V1. Preferred shares redeemed. 6,950 common shares of stock sold under Stock Option Plan and share dividend declared (665,976 shares).
W. Based on shares outstanding at end of 1955.
W1. Shares increased because of company's stock option plan.



Offshore well in Lake Bicarsosse. Drilling operations in the lake were regulated in such a manner as to leave space for regular seaplane landings.

PARENTIS

By Dr. H. Klauschek

Oil and asphalt shows along the Pyrenean foothills have attracted attention for many years, and in the eighties of the last century the asphalt occurrences in the Miocene of the Bastennes salt dome were exploited and used for paving the streets of Paris and London. At various times several very shallow wells were drilled close to surface shows, but only in the twenties of this century were depths of more than 1,640 feet reached. The deepest well of that

Dr. Hans Klauschek, geologist, joined the Jersey group, Central European Office, in 1937. For several years he was chief geologist, with Jersey's subsidiary in Romania. When Esso Standard Francaise started its exploration venture in southwestern France early in 1951, he was put in charge of the geological department.

Prior to joining the Standard Oil Co. (N. J.) he worked mostly for American interests in various European countries and also in the United States. He obtained his doctorate at the former German University of Prague (Czechoslovakia), his home town. He has been a member of the A.A.P.G. since 1930.

The application of combined geophysical and geological methods over an area of nearly four million acres proved its value in France in the discovery of Parentis, the major post-war European discovery. By the end of 1955 Parentis was supplying over 75% of the production of Metropolitan France.

DISCOVERY result of extended research program

period, located on the Ste. Suzanne anticline west of Pau, was 3,122 feet deep. All the wells were dry.

The Jersey group became interested in this area in 1922, but except for the preparation of a few reports, no action was taken then. In analogy with the occurrences along the foothills of the Carpathians in Poland and Romania and along the Caucasus and other mountains, it was believed at that time that the foothill zone of the Pyrenees was the most interesting area. It was quite natural that the great plains of the Aquitanian basin did not attract the explorers because geophysical methods were not yet developed sufficiently.

In 1938, geologists of Jersey's European office called attention to the possibilities of the central and northern parts of this basin. At that time no production of oil or gas existed in the whole region. The discovery well of the St. Marcet gas field, owned by the Regie Autonome des Petroles, started drilling in January 1939, found gas in the basal breccia of so-called Cenomanian in the summer of 1939, but continued drilling to the Triassic and was completed in February-March 1940 as a gas well.

In November and December 1939, Messrs. E. G. Cook and G. Greant of Jersey, and Dr. Pierre Lamare, a distinguished French geologist, made the first on-the-ground study of the area and came to the conclusion (report dated February, 1940) that the Bordeaux Basin was a petroliferous province. The region recommended by this party reached southward to the latitude of Mont-de-Marsan, including the area of Parentis-Roquefort.

After the war, a first permit area Biscarosse-Castel-jaloux-Riberac-La Rochelle was requested in 1947. Following negotiations with the government, a slightly modified request was filed on March 26, 1949, and granted with the decree of Feb. 17, 1951 (*"Journal Officiel"* of Feb. 20, 1951). The surface area is 1,763,650 hectares, or 4,357,980 acres.

The duration of the first exploration permit was five years, with the possibility of two five-year renewals. However, at the first renewal the permit area had to be reduced to one half of its previous size, and at the second renewal 25% had to be given up. The prospector had the right to choose the part or parts to be relinquished. The main conditions were to keep up certain geological, geophysical, and drilling activities and to spend an amount of about Fr. 1,200 million (U.S. $3,500.000) during the first five-year period.

When oil has been found the holder of an exclusive research exploration permit is entitled to a concession valid for 50 years covering the structure proved to be productive. The royalties to be paid are calculated as follows:

On production between			*Royalties*
0	—	50,000 tons/year	0
(0)	—	(1,000 b/d)	
50,000	—	100,000 tons/year	6%
(1,000 b/d)	—	(2,000 b/d)	
100,000	—	300,000 tons/year	9%
(2,000 b/d)	—	(6,000 b/d)	
300,000	—	1,000,000 tons/year	12%
(6,000 b/d)	—	(20,000 b/d)	
On production above 1,000,000 tons/year (20,000 b/d)			14%

History of Prospection by Esso Standard S.A.F.: In April a small exploration staff headed by R. P. Walters was organized and on May 1, 1951, gravity work was started for Esso by CGG (Compagnie Generale de Geophysique, Paris). The area of the northern and central Aquitanian Basin from the ocean to the Massif Central was surveyed, and an exchange agreement with the companies working in the adjacent

Esso well in the Landes. All photographs with this article are reproduced through the courtesy of Esso.

areas in the south was made, so that complete gravity maps of the Bordeaux Basin could be compiled.

Based on these data, residual maps of the permit area were made. These maps showed about 25 strong anomalies and were to serve as guides for the planning of seismic work. The gravity survey was terminated in September 1952.

A few reconnaissance magnetic lines were run across the Bordeaux permit and to the basement outcrops to the north. These suggested that the northern half of the permit was much deeper than had been previously estimated. They did not, of course, give evidence of individual structural features.

Planning of Exploration: To explore an area of over four million acres in less than five years in an economical way requires a strategic approach. The discovery of oil at Parentis in a relatively short time was due to the combined application of geological and geophysical methods.

Beginning in 1951, the paleogeography of southwestern France was studied and a set of maps showing knowledge of the paleogeography and distribution of facies was made. They were based on studies made by two field parties along the rims of the basin and on office studies of available maps and publications. A very important source was SNPA's well at Roquefort, which at that time was the only deep well drilled close to our permit area, i.e. 12 miles south of its southern boundary.

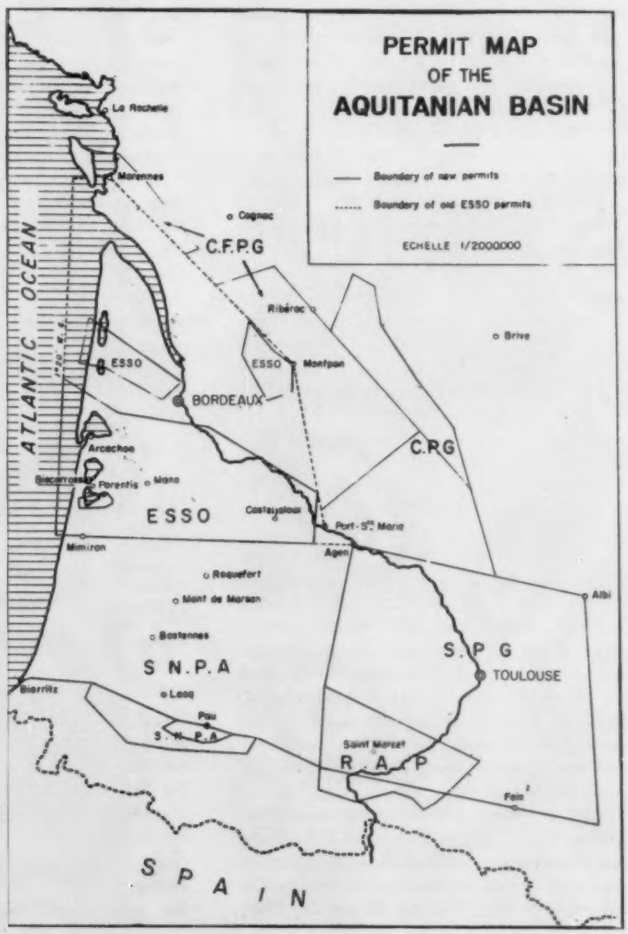
As a result of the geological and geophysical studies the southwestern part of Esso's permit area was considered the most favorable, because of the probability of a rather complete, thick sedimentary section. Particularly the Lower Cretaceous was thought to be present and well developed here, while probably absent over most of the rest of the area. It was not known at that time that the Lower Cretaceous was oil bearing, except for small surface shows, as they were known from several formations in the southern Aquitanian basin. The oil of Lacq occurs in the Senonian (Upper Cretaceous) and the gas of St. Marcet in the Cenomanian (Upper Cretaceous). On the northeastern rim of the Basin, from the Atlantic along the Massif Central to the Montagne Noire east of Toulouse, the Lower Cretaceous is missing. It was known to exist in the well at Roquefort and to be missing in that of Agen. Owing to the absence of wells drilled in the central parts of the basin, which is covered by Quaternary and Tertiary deposits, ideas about the deeper formations were necessarily rather vague despite these studies.

Seismic work started in April 1952 and was executed by Compagnie Generale de Geophysique (a subsidiary of Schlumberger). Considerable difficulties were encountered in securing reflections because of the surface and near-surface conditions. These were only overcome by extensive experimentation involving various patterns of geophone location.

In the beginning, well-developed, large strong positive gravity anomalies in the southwestern part were selected for seismic checking, the first being that of Mano. After completing this survey some weak gravity anomalies south and west of Mano were checked, among them the gravity nose off the big Mimizan anomaly. The first two lines over this nose led to the discovery of several structures, among them that of Parentis in May 1953.

The first structure to be drilled was that of Mano, April 18 to Sept. 18, 1953. In this well the top of the Cretaceous was found at 722 feet and the Wealden at about 2,919 feet, followed by more than 5,904 feet of Jurassic. The well was stopped at 9,017 feet in Liassic because of the limited capacity of the rig. It showed some weak oil traces in the Middle Jurassic (color in chloroform), the first oil indications in the Meso-

Installing Christmas tree on Parentis No. 4.



zoic of the Bordeaux Basin outside of the zone of surface diapirs in the southwestern corner, 48 miles to the south. Equally important was the occurrence of rather thin Valanginian and Wealden (Lower Cretaceous), both of which were recognized here for the first time in the Bordeaux Basin.

Simultaneously with drilling at Mano, exploration of the area south and southwest of Mano was carried on. As mentioned before, our attention was attracted to this general region because we expected from a regional study of water wells a thicker stratigraphic section in the Tertiary and from paleogeographical studies, also, a better developed section of the Lower Cretaceous. The area of Parentis was suggested for seismic survey on account of the gravity nose extending northeastward from the large Mimizan gravity high. The main high was thought to be caused by the basement, while the nose suggested a structure of interest for oil.

Seismic work around Parentis went on from April to the end of August 1953 and a location was made shortly afterwards. The seismic contours showed a roughly east-west trending structure, the axis of which lies in the lake of Parentis. Drilling began on Oct. 30, 1953. It was done under contract with the Forex Co. The total depth of 7,867 feet was reached on April 24, 1954, after a shutdown of about two and a half months at a depth of 6,747 feet due to a change-over to a heavier drilling outfit.

The main geological and technical data are as follows: spudded in, Oct. 30, 1953; suspended, Dec. 22, 1953; drilling resumed, March 11, 1954; well completed, April 24, 1954.

Formation Contacts

0— 223 feet-Quatenary and Pliocene
223—1,509 feet-Miocene (sand—shale)
1,509—3,369 feet-Oligocene (limestone—sandstone—shale)
3,368—4,959 feet-Eocene (sandstone—shale)
4,959—5,576 feet-Upper Cretaceous ("Upper Limestone Series," chalky with chert)
5,576—7,291 feet-Albian and Aptian ("Shale Series" 5,576—6,724 feet black calcareous shale)

Producing Zone

6,724—7,291 feet—("Lower Limestone Series")
7,291—7,741 feet—Neocomian (Dolomitic Zone)
7,741—7,866.7 feet (total (total depth)—Jurassic (Dolomitic Zone)
Rotary table elevation: 88.2 feet

The Tertiary consisted mainly of marine shales, sands and marls of great thickness—almost 5,000 feet as against 500 feet at Mano. The Upper Cretaceous, about 656 feet, is made up of shales and marls with some limestone and sandstone beds. A chert zone marks the base of this formation. It is followed by a shale series about 1,148 feet thick of Albo-Aptian age. At 6,724 feet in Parentis 1 an Aptian limestone was encountered, and at 7,291 feet, on March 23, a dolomite which showed fluorescence and color in chloroform was found.

Circulation was lost while coring at 7,339 feet in a very fractured formation. On March 25, the first test was made: the depth of the hole was 7,339 feet, the packer was set at 7,303 feet, the diameter of the hole 8½ inches. The Johnson tester was opened for 30 minutes, but became clogged by cuttings after 20 minutes. During this period 18.2 barrels of liquid, of which 17.6 barrels was oil, was produced against a water cushion of 972 feet.

After two more preliminary tests, a final open hole test was made from April 26 to 30. Total depth of the well: 7,866.7 feet, open hole from 7,344 feet to bottom. Shoe of tubing at 7,383.9 feet without casing packer.

The initial test of this well resulted in production of 1,252 barrels of 32° API oil per day. Subsequent tests indicated it to have the highest potential rate of any well in Western Europe, but it could only be flowed at a much lower rate to prevent the influx of water from below the oil. The G.O.R. was about 35 cubic feet of gas per barrel of oil.

As indicated on the map of the Parentis field, there are thirteen productive oil wells completed in the Parentis field, of which one, No. 7, is not yet on production. The best wells are in the center and southern parts of the field, where the fractured and vugular dolomite is present above the water table.

Development of the western portion of the Parentis field must necessarily be slow and cautious, as there is considerable irregularity in the important dolomite producing section. Additional caution is imposed by the presence of the north-south faults, which have displacements up to about 100 meters.

Present data indicates that the western end of the field will terminate in the small lake, where drilling platforms have to be erected in water up to 60 feet deep.

Production of the Parentis field averaged about 16,500 barrels per day during the month of January 1956.

Geophysical crew in the Landes.

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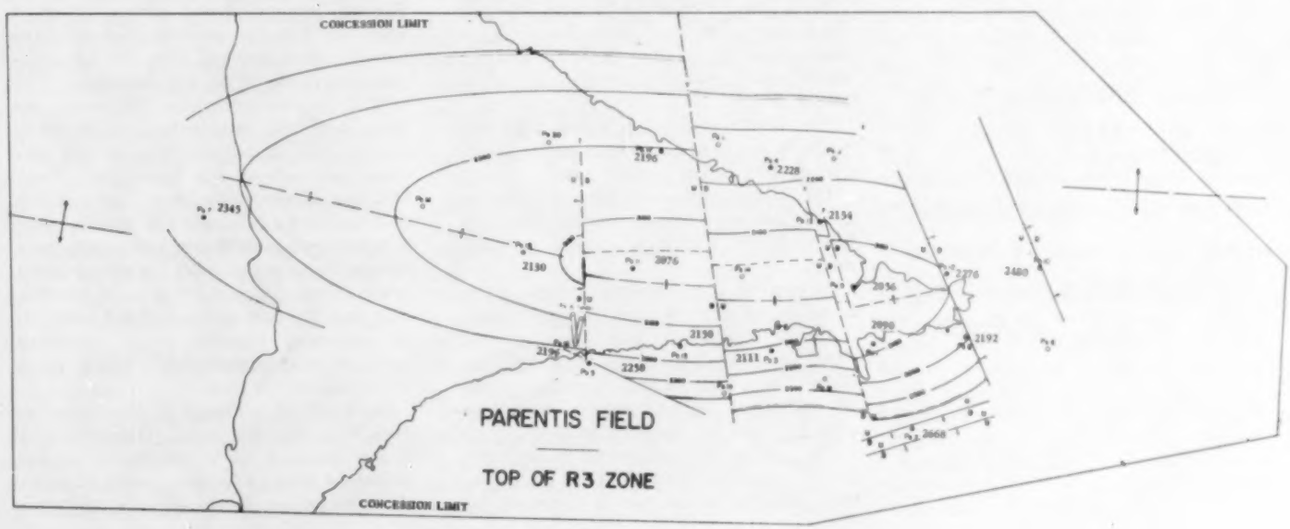


A rig drilling a new location in Mexico.

Oil keeps pace in MEXICO

Mexican production rose by 11.06%, exports by 11.02% in 1955. Imports still exceed 10% of domestic demand, however, because of internal transportation and refining difficulties.

Petroleos Mexicanos' annual report on the 18th anniversary of the expropriation was delivered by Senator Antonio J. Bermudez, director of Pemex. His report covered 1955 and part of 1956. It revealed that Mexico has not yet conquered her traditional problem of adjusting internal oil transportation and refining output to domestic demand, although production and exports are up. A summary of the Pemex report follows:

Exploration during 1955 consisted of 25 geological, 17 seismic and 5 gravity meter crews, working in the states of Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, San Luis Potosi, Veracruz, Puebla, Oaxaca, Tabasco, Campeche, Yucatan, Chiapas and the territory of South Lower California.

Fifteen new productive oil and gas fields were discovered: at Allende, Chote, Acuatempa, Vicente Guerrero, Alazan Oriental, Temapache Oriental, Macarena, Nuevo Progreso, Chichimantla, Tres Higueras and Tecuilolapa in Veracruz; Canon and Berrendo in Tamaulipas; El Pato in Nuevo Leon, and Bitzal in Tabasco. During 1956 three more oil fields have been located: Tamaulipas in the state of the same name, and Mesa Cerrada and Agata in Veracruz.

Drilling: Pemex drilled 330 wells, about 13% over 1954. Total footage was 1,790,880. Average depth was 5,427 feet. This drilling was a record for Mexico, exceeding the former record year of 1926 when 1,764,640 feet were drilled.

Oil and gas reserves increased 7.7% to 2.81 billion barrels. Production of crude, distillates and absorption gasolines averaged 251,016 b/d (of which crude was 244,703 b/d), in spite of hurricanes.

Present production is 265,930 b/d (of which crude is 249,764 b/d), 98,300 in Poza Rica and 168,630 elsewhere. This output will rise to 282,000, according to Pemex as soon as the Angostura field is put into capacity production through completion of the oil pipe line to Veracruz, and termination of repairs to wells in Panuco and on the Isthmus.

Pipe line transportation in 1955 was increased by:

(1) Construction of an 18-inch, 146-mile crude line from Poza Rica, Veracruz, to Atzcapotzalco, in the Federal District, which makes possible pumping of up to 115,000 b/d;

(2) Construction of a 4-inch, 146-mile products line over the same route for transporting 3,000 b/d of propane gas.

(3) Enlargement of the Minatitlan-Salina Cruz pipeline's pumping capacity from 15,000 to 30,000 barrels of refined products daily.

At present, the following projects are in an advanced stage of construction:

(1) A 12-inch pipe line, 294 miles long from Tampico, Tamaulipas to Monterrey, Nuevo Leon, with an initial capacity of 25,000 barrels of refined products daily. This capacity could be expanded to 50,000.

(2) A pipe line, 20 inches in diameter and 48 miles long from the field at Angostura, Veracruz to the port of Veracruz, for pumping 25,000 barrels of heavy crude daily.

Volume of crude processed in Pemex refineries in 1955 was 80,500,000 barrels (220,548 b/d).

Imports in 1955 were 41,370 b/d, of which 70.3% was by Pemex and 29.7% by others. Total value of imports climbed to 892,733,000 pesos ($71.4 million) which had to be converted into dollars. Petroleos Mexicanos took a loss of $21.2 million on this item—the difference between its cost and sales prices within the country.

"Within our territory," said Senator Bermudez, "are regions we cannot economically supply with our own production either because of a lack of communications or high distribution costs. The imports which are necessary and convenient amount to some 4.6% of the volume of our petroleum and derivatives. During 1955, 10.4% of the domestic demand was met with imports—which means 5.8% of the importation is inconvenient.

"The production of crude exceeds national consumption by more than 10,000,000 barrels a year. The cause then is not a shortage of crude but lies in the disparity between the nature of the domestic demand and the ability of our refinery system to turn out the quantity of each of the refined oils required by the market.

"Domestic demand is increasing daily, and is much greater in the case of gasolines and other light products. While we had to boost our production of refined products 27,000 b/d from 1954 to 1956, the increase in the demand for fuel oil was only 12,800 b/d. The refinery facilities at our disposal leave us with surpluses of residual products that cannot be absorbed by the nation, and with a shortage of light products we must import. With adequate installations, these residual surpluses could furnish raw material for products now imported. Our problem consists in the necessity of installations for converting residues into light refined products.

"Fundamental to this purpose are the catalytic cracking plants scheduled for the Atzcapotzalco, Tampico and Salamanca refineries—projects being carried forward with the celerity permitted by our resources, since they call for a combined investment of about 750 million pesos.

"The recently completed Minatitlan refinery will help us solve the import problem by making it possible to deliver national products to the West Coast. Construction of outstanding importance during 1955 included a lubricant and paraffin plant at Salamanca, Guanajuato with a daily production capacity of 2,400 barrels of high-grade lubricants and 100 tons of paraffin. Cost was 310 million pesos ($24.8 million). It eliminates imports which otherwise would have amounted to 170 million pesos ($13.6 million) in 1956."

On April 12 additions to the plants at Poza Rica were completed. They consist of a unit doubling the processing of natural gas and a water-injection system. In addition, the power plant and gas-reinjection

EXPLORATORY DRILLING IN MEXICO IN 1955

Geologic Province	Well Classification	Producers: Oil Number	Producers: Oil Footage	Producers: Gas Number	Producers: Gas Footage	Total Producers Number	Total Producers Footage	Dry Number	Dry Footage	Grand Total Number	Grand Total Footage
Baja California (Iray-Purísima Embayment)	New-Field Wildcats	0	0	0	0	0	0	2	14,153	2	14,153
Campeche Yucatan Peninsula	New-Field Wildcats	0	0	0	0	0	0	2	15,042	2	15,042
Tabasco Region and Saline Basin	Outposts	5	15,721	0	0	5	15,721	3	13,625	8	29,346
	New-Pool Wildcats	8	34,042	0	7,710	10	41,752	0	0	10	41,752
	Deeper-Pool Tests	1	1,607	0	0	1	1,607	0	0	1	1,607
	Shallower-Pool Tests	1	3,773	1	935	2	4,708	0	0	2	4,708
	New-Field Wildcats	1	5,419	1	9,120	2	14,539	9	51,171	11	65,710
Tamaulipas (Northeast Mexico)	Outposts	0	0	3	19,435	3	19,435	0	0	3	19,435
	New-Pool Wildcats	1	7,750	2	12,083	3	19,793	0	0	3	19,793
	Deeper-Pool Tests	0	0	5	32,700	5	32,700	0	0	5	32,700
	Shallower-Pool Tests	0	0	1	4,324	1	4,324	0	0	1	4,324
	New-Field Wildcats	1	8,212	2	18,935	3	27,147	7	52,755	10	79,902
Tampico Embayment	Outposts	1	2,295	0	0	1	2,295	1	9,992	2	12,987
	New-Pool Wildcats	0	0	0	0	0	0	4	10,567	4	10,567
	New-Field Wildcats	8	35,682	1	3,248	9	38,930	26	106,456	35	145,386
Veracruz Embayment	Outposts	0	0	0	0	0	0	1	6,004	1	6,004
	New-Field Wildcats	1	1,768	0	0	1	1,768	13	60,188	14	61,886
Total Exploratory Holes		28	116,929	18	108,490	46	225,419	68	339,883	114	565,302

The above table was taken from a report by Dr. Frederick H. Lahee, Chairman, A.A.P.G. Committee on Statistics of Exploratory Drilling. The report covering the United States is contained elsewhere in this issue. Mexican statistics were supplied Dr. Lahee by Ings. Antonio Garcia Rojas and Frederico Mina of Petroleos Mexicanos. Dr. Lahee's complete report is being published in the June issue of the A.A.P.G. Journal.

installation were enlarged at a cost of 246,-500,000 pesos ($19.7 million). Immediate benefits are an additional recovery of 3,000 barrels of propane daily, a similar quantity of natural gasoline and 1,230 barrels of butane.

In July new installations increasing the processing capacity of the Atzcapotzalco refinery from 50,000 to 100,000 b/d were completed. They cost 89,418,710 pesos ($4.1 million), and constitute the first phase of the expansion of this refinery.

In December, the Reynosa absorption plant, which is capable of treating 300 million cubic feet of gas and of producing 8,000 barrels of products daily, came on stream. Its cost was 100 million pesos ($80 million). Its operation marks the start of a program for supplying the gas needs of northeastern Mexico as well as providing appreciable amounts for exportation under terms of a contract signed in 1955.

On February 22, 1956, the new Minatitlan refinery was completed with a capacity of 50,000 b/d. The cost was 154,800,000 pesos ($123 million).

In 1956 Pemex' program includes:

(1) A catalytic plant in the Atzcapotzalco refinery;

(2) Extension of the gas recovery system in Poza Rica to cover recently discovered fields;

(3) A gas absorption plant in Pemex City, Tabasco;

(4) Modernization of the Madero City refinery in Tampico, including installation of catalytic cracking and power plants;

(5) A catalytic plant in the Salamanca refinery;

(6) A grease and drum plant in the Salamanca refinery;

(7) Modernization and enlargement of the capacity of the primary refinery at Poza Rica.

Exports mounted during 1955 to 70,777 b/d, 11.02% above 1954. Hurricanes that swept the coast of the Gulf of Mexico in September and October prevented export of approximately 4 million barrels valued at 87,500,000 pesos.

"Distribution of products to the national market," said Senator Bermudez, "presents difficulties due to the configuration of our territory, which hampers land transportation of large quantities of petroleum derivatives. The zones most affected are those farthest from the refineries. Regions where this problem arises from time to time are: (1) Monterrey-Torreon-Chihuahua; (2) Zacatecas-Durango; (3) Oaxaca-Chiapas, and (4) the west coast.

"The problem is not scarcity, since there is an abundant supply of products available, but involves the speed and availability of transportation. Pemex has made and continues to make every possible effort to keep our sales agencies supplied, to the point of absorbing the higher costs of highway transportation to points which could be supplied by railway. In 1955, we shipped 1,890,359,000 liters by highway at a 10 million peso loss—the difference between the charges for this service and what would have been charged had the same amount been moved by rail.

"One method of relieving this situation is transportation by pipe lines, which we have already built from Minatitlan to Salina Cruz, from Salamanca to Morelia, Salamanca to Lagos-Guadalajara and Aguascalientes, as well as that under construction from Tampico to Victoria and Monterrey. We are also planning a pipe line from Guaymas to Obregon City and Navojoa, another between Guaymas and Hermosillo, and prolongation of the Tampico-Monterrey line to Torreon.

"During 1955, storage and distribution plants were completed in Puebla, Aguascalientes, Salina Cruz, Tepic and Hermosillo, and others are being built in Acapulco, Guamuchil, Los Mochis, Monterrey, Victoria City, Veracruz and Lerma.

"We are also considering the purchase of at least three maritime tankers and 100 railway tank cars.

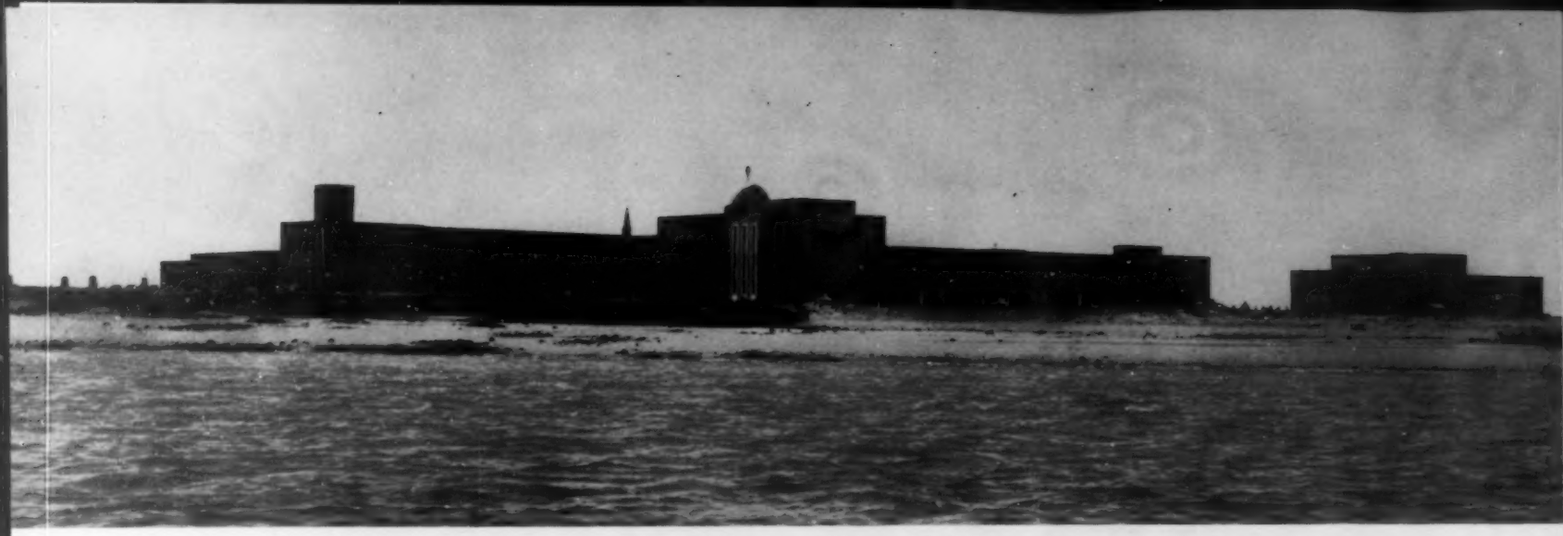
"The principal obstacle to the greater progress of Petroleos Mexicanos is the decline of its resources as a result of the uneconomic prices on the domestic market and the granting of subsidies for the collective welfare in the form of discounts.

"During Petroleos Mexicanos' 18 years of existence, consumers have enjoyed extremely low prices. It is evident they have not followed the ascending curve of those for other goods.

"However, due to the constant increase in the costs of operation arising out of higher prices for materials, tools, equipment and services, the sales prices of our products are uneconomic. For that reason, we have continually called attention to the necessity of revising the prices of some petroleum products.

"The world petroleum industry maintains a high level of investment for both replacement of its reserves and expansion from the income received from the sale of its products. The secret of its growth is a system of remunerative prices.

"It would be a grave responsibility not to bring this situation to the consideration of the nation, for if we continue to sustain some sales prices far below production costs, we would be damaging our patrimony. Stagnation of the industry would be the first harmful effect. To impede development of the oil industry would be to handicap what should be a triumph without precedent in our economic history. We must face reality and study the need for this readjustment as an essential condition for continuing the growth demanded by Mexico's progress. This growth is one of the most solid foundations for the advancement of the country's general productivity and the living standard of its people."



School building, secondary school, Shuwaikh.

On a per capita or a total basis, oil revenues in Kuwait are among the highest in the Middle East. Among the current uses to which oil income is being put are fresh water and electricity supply, road development, free education and medical care. In addition substantial amounts are being invested outside the country, since lack of internal resources limits the total of economic development.

IMPACT OF OIL ON KUWAIT

By E. Lawson Lomax

SINCE discovery of commercial production in Kuwait in 1938, oil revenues have risen steadily with increasing production as the accompanying table shows.

Under the agreement between Kuwait and the oil company, one-half of the profits realized from the sale of the crude oil, without deductions, is paid to Kuwait.

What this half profit amounts to is, to a certain extent, a matter for conjecture, as no official figures are published. It is probably between $0.37 and $0.75 per barrel, with a bias in favor of the midway figure of $0.56 per barrel. On this latter assumption, the oil income of Kuwait in 1955 was more than $4.2 million per week.

The population of Kuwait has been considerably increased in the last 10 years by the immigration of skilled and semi-skilled workers from neighboring states. A close estimate is 200,000, of which about 75% dwell in or near the capital and the oil-field towns, the remainder consisting mainly of nomad Bedouin.

The company's permanent labor force has now become fairly stable at about 5,600, most of whom are Kuwaitis, the remainder being Arabs from other neighboring states, Indians and Pakistanis, who have made their homes in Kuwait. This labor force is subject to quite an amount of change. It was recruited from the largely illiterate population scattered over the desert or in the small coastal towns, taken in quite green by the company and specially trained. When they have received a certain amount of this training they become valuable to the various contractors who are carrying out work for the state and then leave the company's employ to be replaced by other trainees.

Apart from oil profits, this technical training of the country's nationals is a contribution to the economy of the country, and has a direct impact on the development of its urban population.

It is difficult to estimate what effect, if any, the profits from petroleum have had on the lives of the nomad Bedouin, whose occupation is herding of camels, sheep, and goats. They are descendants of many tribes of Arabs, marked by their black tents, which are almost universally used by the Kuwaiti Bedouin. Like other desert tribes they do not recognize international frontiers. Some of the Kuwaitis inhabit the few oases and engage in primitive forms of agriculture.

The greater impact of the profits from oil is among the urban population, mainly around the town of Kuwait located at the southeast corner of the Bay of Kuwait. Before the advent of the oil industry into the country, the town of Kuwait was noted for its shipping and shipbuilding industry and also was a pearling and fishing center. Boat building and shipping have declined, as also has the pearling industry owing to the popularity of the cultured pearl, but fishing still remains to satisfy the demands of the increased population.

In the last few years conditions have completely changed and Kuwait Town now has facilities of many modern cities, without losing its Arab atmosphere.

A large amount of demolition of the old property, with its walls built of coral taken from the sea, with cement or mud used as mortar and then plastered over with burned limestone, has taken place to allow main streets, asphalted and lit by electricity. A number of modern shops have been built which are well stocked with products from the western world, ranging from canned food to washing and sewing

Mr. Lomax of the London offices of WORLD PETROLEUM *has just completed a visit to the oil fields of the Middle East. This is the first of a series of articles written on his trip. Others will follow in subsequent issues—Editor.*

machines. Jewellers carry large stocks of ornate jewelry and watches of all the famous makes.

Motor traffic in the town of Kuwait itself, is the heaviest in the Middle East. Beirut, which had the reputation of being the most congested town in that respect, now has taken second place to Kuwait. Many of the automobiles in Kuwait are the latest modern American models, comprised mainly of Chevrolets, Fords, Chryslers, Buicks and Cadillacs, in a variety of colors.

Kuwait has changed in recent years in many other ways. The ruler of Kuwait, Shaikh Sir Abdulla al Salim al Subah, is using large portions of the revenues received from the production of oil in development of the country on modern economic lines, although apart from oil, Kuwait has no other major natural resources which can be developed.

One of the major shortages in Kuwait has been that of fresh water. The water table throughout the country is brackish, too saline for either agricultural or domestic use. A project for the diversion of some of the sweet water of the Shatt-al-Arab, either through a canal or by pipe line into Kuwait, has been shelved due to political considerations.

A water distillation plant of a capacity of 1,000,000 gallons per day, has been provided out of oil income; a second plant of the same capacity is being built and a third one is projected. The fuel for these distillation plants is natural gas, supplied from the oil fields 25 miles away. The distilled water is mixed with about 10% of brackish water, from wells at Sulaibiya, some 20 miles away from Kuwait, to overcome the lack of flavor in straight distilled water, and also is chlorinated and filtered for sanitary reasons. The treated water is stored in high level water towers for distribution through the domestic service pipes to Kuwait Town and its suburbs, thus ensuring a constant pressure supply. This water is also distributed by road tank truck over a wide area outside the urban districts. With the low cost of fuel used, one would expect the water to be reasonable in price, but according to Western standards this is not so.

The city of Kuwait and the suburbs of Shuwaikh, Jewan, Sulaibikiyat, Salamiya and Hawali are at present the only places where electricity is distributed, but it is proposed to extend this service in the near future. The main power station has been erected in the industrial zone of Shuwaikh, to the west of Kuwait City. It consists of four turbo-alternators with a total capacity of 30 megawatts, one set being a standby. The normal output is 22.5 megawatts. A further station is projected with a nominal capacity of 40 megawatts. The fuel used in this station is again natural gas from the oilfields, which should ensure low running costs, but the selling price equivalent to 4d. (about 5 cents) per unit, seems unduly high under these favorable conditions.

In addition to this central station a local supply is also contemplated for the village of Jahra, a key point on the main government road between Kuwait Town and Basra in Iraq.

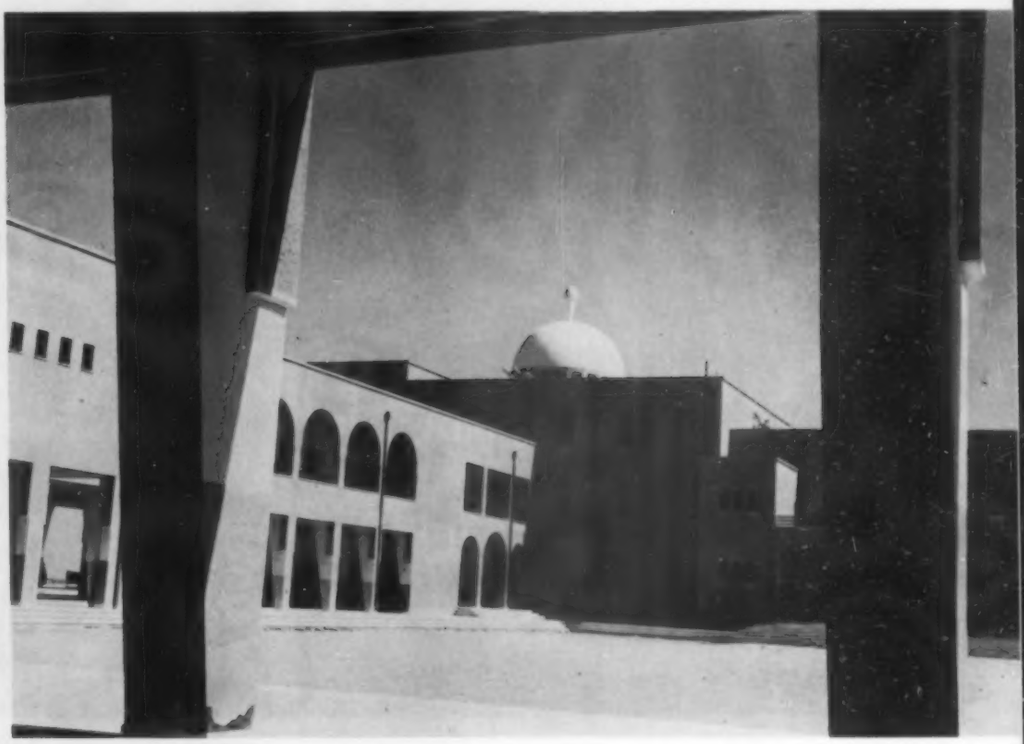
A large amount of roads are being built, which compare favorably with motor roads in western countries. The main roads of Kuwait Town have all been paved and asphalted and there is also an asphalted perimeter road round the old town hall.

Some of the roads in the country were built and developed originally by the Kuwait Oil Co. to carry traffic to and from the oilfields. One of these is a paved road from Shuwaikh to Ahmadi. The other roads have been built in line with the development program adopted by the ruler of Kuwait. These include a main motor road, between Kuwait Town and Basra in Iraq, which is now about 30% complete. There is also a coastal road between Khor al Mufatta in the Neutral Zone and Ahmadi, under construction. A coastal road is also projected to link up Mina-el-Ahmadi, which is already connected by a good road with Ahmadi, with the sea coast villages to the south and with the neutral zone. Asphalt used in these roads is produced from the refinery of the Kuwait Oil Co. at Mina-el-Ahmadi.

The provision of fresh water, electric power and paved roads are not all the developments from oil income. The development program adopted by the ruler covers a much wider range. One of the major items in this program was the conversion of the city of Kuwait into the most modern town in the Middle East, with high-class living accommodation for all grades of the

Electrical trainees.

The new state secondary school, Shuwaikh.



Crude Oil Production in Kuwait

Year	Tons	Barrels	No. of Wells Producing at end of year
1946 (from 30th June)	797,350	5,927,979	8
1947	2,185,309	16,227,906	13
1948	6,291,577	46,546,795	32
1949	12,183,669	89,930,444	61
1950	17,018,666	125,722,396	78
1951	27,783,170	204,909,662	109
1952	37,042,122	273,432,895	126
1953	42,603,244	314,592,486	149
1954	46,969,415	347,319,293	163
1955	53,894,068	398,816,103	

population. With this end in view, town planning consultants were engaged and the plans are now in development. They include, as mentioned before, the demolition of some of the older buildings in the town to allow for widening of the streets, and to leave space for the erection of public buildings and re-planning of the market. The program also calls for the development of residential and industrial areas outside the perimeter of the town.

High priority has been given to the provision of free educational facilities and medical treatment. Free uniforms, both cold weather and hot weather, are provided for all students. Meals in all schools are supplied free. Many modern school buildings have been erected, much better equipped than many schools in Western countries.

Education of this type is new in Kuwait and sufficient teachers to carry it out can not as yet be found among the Kuwaits. The system has therefore been based on that of Egypt, educationally the most developed among the Arab countries, and is being carried out partly by teachers from that country. It consists of a three years infant course, followed by an elementary course of four years and then a course in a secondary school of five years. At the end of this period of training the pupils should be able to take the matriculation examination of the Egyptian universities.

The new secondary school at Shuwaikh comprises a very fine group of buildings, including an assembly hall, class rooms designed on modern lines, with glass walls and tiled floors and ceilings. There are also fully equipped science laboratories and a library, together with sports fields and a swimming pool. As many of the pupils will be drawn from outside Kuwait Town, boarding houses are provided and quarters for the teaching staff. A Mosque has also been built, as religion plays a great part in the education of Moslems. Education in this school is not confined to Kuwaitis; the pu-

Aerial view of the central square, Kuwait Town.

Oblique view of Shuwaikh industrial area including sea water distillation plant.

pils include some from other Arab countries.

A technological college with accommodation for 200 students has been built, in which students can be trained in industrial techniques. At the present time this college does not have its full complement of students.

The building of a university city was one of the major items in the development program and this has now been practically completed. All the main buildings, which cover a frontage of about one mile, have been erected and furnished, and is being carried out on the surrounding territory. Among other things a large sports stadium has been laid out.

When the plans are fully developed, there should be ample accommodation for all classes of students up to university grade. At the present time there are some 180-200 Kuwaitis undergoing university grade education abroad, the major portion of them attending Egyptian universities, the remainder undergoing specialized training at Western universities, mainly in England. It will be from these and similar students that the future teaching staff in Kuwait will be drawn; but there is a considerable back-log to make up. For some time reliance will have to be placed on teachers from other Arab countries, which under present conditions may not be altogether in the best interests of Kuwait.

One of the major advantages to the country from oil is a free state medical service, available to all Kuwaitis. There is a fine state general hospital in Kuwait Town, fully equipped for all types of medical and surgical service. A second large hospital has been built at Sulaibikiyat, five miles away from the town, for the use mainly of the large labor forces employed on the general development projects. A tuberculosis sanatorium has been built close to the shores of the bay, with accommodation for 300 in-patients; a fully equipped dental center has been built, where all classes of dental treatment can be carried out. Of special importance is an ophthalmic center, which in Kuwait where in the past ophthalmic diseases have been rampant, is an absolute necessity.

The above facilities are not all the medical services. A new general hospital with 750 bed accommodation is almost complete, as well as a further tuberculosis sanatorium for 200 patients, under construction in Shuwaikh. Medical clinics have also been established in various rural centers in the country, where preliminary and ordinary medical treatment can be carried out.

The medical and dental services are at present under the control of a British chief medical officer, who has under him a large staff of imported doctors, surgeons, ophthalmists, dentists and nurses, together with Kuwaiti trainees. A number of Kuwaiti medical students are at present being trained abroad. It is intended that they will gradually replace the foreign staff.

These projects have brought large expenditures within the country, and a large portion of this internal expenditure has been on local contractor's labor, and materials supplied by local contractors as agents or manufacturers. As a result there has been a surge of spending by all classes of the community who, in the past, relied on barter for a large proportion of their necessities. This type of expenditure, mainly on luxury goods, such as automobiles, cameras, radios, watches and jewelry, etc., has probably reached its peak and will diminish in the future, when the present development plans have been completed, but that is a matter for conjecture.

The ruler of Kuwait is allocating a portion of the annual income for the formation of a sinking fund by investment in gilt-edged securities, external to the country. He has appointed an Investment Board to advise him regarding these investments. In Iraq, 70% of the petroleum income is administered by the Iraq Development Board, and is used among other ways for the development of the natural resources of the country, so that it can to a large extent become self-supporting. Kuwait, however, has few natural resources capable of development as in the case of Iraq, and so the formation of this sinking fund in some ways serves the same purpose.

The control of the country is directly under Shaikh Sir Abdullah al Salim al Subah. According to Arab traditions he appoints the heads of the various state departments and personally supervises the administration of their offices as well as the expenditure of oil revenues. Under the present ruler's guidance, it would appear that Kuwait will enjoy a long period of prosperity, provided no external influences intervene, although in view of the troubled Middle East situation no definite prediction can be made.

Filling station at Al-Hawalli, Kuwait.

Total exploratory footage drilled in the U.S. during 1955 was up 16.1% over 1954. Average hole depth increased 1.8%. Of new-field wildcats drilled on technical advice, 11.2% were successful, compared with 7.2% successful on a non-technical basis.

EXPLORATORY DRILLING IN 1955

By Dr. Frederick H. Lahee

Dr. Frederick H. Lahee who recently retired as geological and research counsellor of Sun Oil Co. presented a summary of exploratory drilling operations in North America for the 20th time at the recent annual meeting of the American Association of Petroleum Geologists at Chicago. Having retired after 37 years of active service with Sun, Dr. Lahee announced that he also is retiring as chairman of the AAPG Committee on Statistics of Exploratory Drilling.

When he first began gathering data on exploratory drilling 20 years ago the report covered only parts of Texas, New Mexico and Arkansas, all of Louisiana and Alabama, Georgia and Florida. The project created so much interest that it was extended to cover all of the United States and finally Canada and Mexico. It has been published annually in the June number of the AAPG Journal and widely reviewed by oil industry magazines. Dr. Lahee noted in his final report that in recent years he has spent 60 to 70 days per year in compiling the data submitted to his committee.

In the years since the project first was undertaken the committee suggested a system of classifying exploratory wells which has been adopted throughout the industry.

In 1938, the first year in which data was gathered for the entire United States the industry drilled 2,638 exploratory holes with a total of 8.8 million feet. This past year 69 million feet of hole was drilled in 14,937 exploratory tests. Of these 8,104 were new-field wildcats, 3,629 were new-pool tests (including new-pool wildcats, deeper-pool tests, and shallower-pool tests), and 3,204 were outposts. Among the new-field wildcats, 918 were successful; among the new-pool tests, 1,069 were successful; and among the outposts, 1,118 were successful.

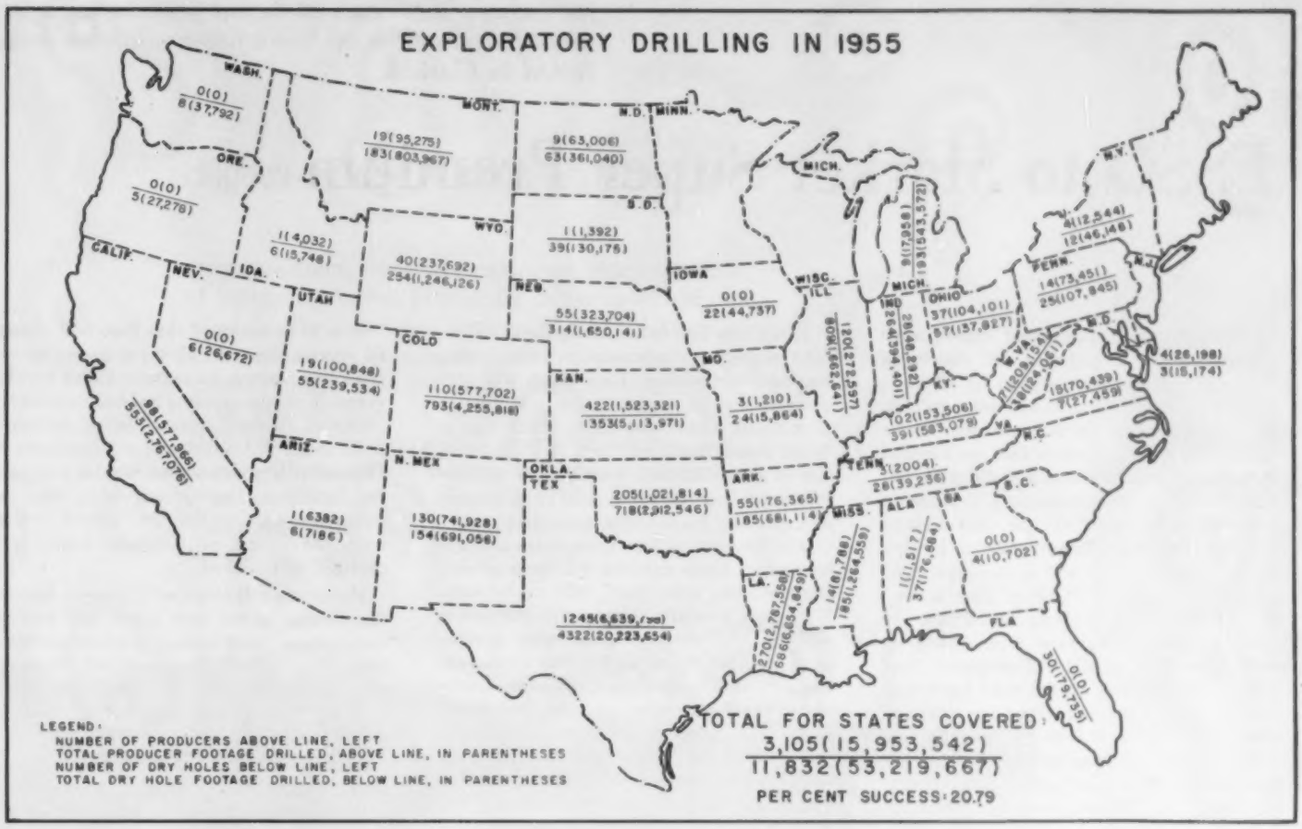
The total exploratory footage drilled in the United States in 1955 was 69,173,209 feet in the 14,937 holes, or 4,631 feet per hole. These figures compare with 59,581,038 feet drilled in 13,097 exploratory holes, with an average depth of 4,549 feet in 1954.

Success was achieved in 20.79% of the holes drilled, and 23.06% of the footage drilled in 1955. One producer foot was drilled for every 3.34 feet of dry hole. One successful well was drilled for every 3.81 dry holes. The average depth of hole was 4,631 feet.

Using the best information available, the 120 men who contributed to Dr. Lahee's

Percentage of Exploratory Holes Drilled in Each Class in United States in 1954 and 1955

	1954			1955		
	Number	Well Per Cent	Class Per Cent	Number	Well Per Cent	Class Per Cent
Outposts						
Producers	923	35.06		1,118	34.89	
Dry Holes	1,709	64.94		2,086	65.11	
Totals	2,632	100.00	20.09	3,204	100.00	21.45
New-Pool Wildcats						
Producers	594	24.22		712	24.29	
Dry Holes	1,859	75.78		2,219	75.71	
Totals	2,453	100.00	18.73	2,931	100.00	19.62
Deeper-Pool Tests						
Producers	153	35.01		186	40.00	
Dry Holes	284	64.99		279	60.00	
Totals	437	100.00	3.34	465	100.00	3.11
Shallower-Pool Tests						
Producers	136	69.74		171	73.39	
Dry Holes	59	30.26		62	26.61	
Totals	195	100.00	1.49	233	100.00	1.56
New-Field Wildcats						
Producers	902	12.22		918	11.33	
Dry Holes	6,478	87.78		7,186	88.67	
Totals	7,380	100.00	56.35	8,104	100.00	54.26
Total Producers	2,708	20.68		3,105	20.79	
Total Dry Holes	10,389	79.32		11,832	79.21	
Grand Totals	13,097	100.00	100.00	14,937	100.00	100.00



report found that 786 new-field wildcats drilled on technical advice (geology and/or geophysics) were successful, and 5,899 were dry; 32 holes, located for non-technical reasons, were producers, and 411 were dry; 100 producers and 876 dry holes were located for reasons unknown. These figures show that 11.7% of the new-field wildcats drilled on technical advice were producers as contrasted with 7.2% successful in the case of holes located without technical advice. Therefore, in 1955, locations for new-field wildcats based on technical recommendations were 1.6 times as successful as those drilled without such advice. Seismographic methods were largely responsible for 321 producers and 1,659 dry holes, among the new-field wildcats.

In the opinion of the AAPA Committee the facts are of greatest importance which pertain to the "rank" wildcats, or the wells which, when they are successful, discover entirely new *fields*. In the last 11 years in the United States, these have comprised 54.58% of the total number of exploratory holes. Of these new-field wildcats, during the last 11 years, the percentage located on technical advice has risen from 85% to over 90%. In this same period nearly three times (2.8) as many new-field wildcats have been successful when located on technical advice as those not so located. Taking all new-field wildcats into consideration there has been an almost constant success-to-failure ratio. The average for the 11 years has been 11.21%, with a range from a low of 10.65% to a high of 12.22%. That is, one hole in every nine has found some oil or gas.

But even more significant than these figures has been the total ultimate reserves of oil discovered by these new-field wildcats. Briefly, this study, which is based on fields having a minimum of six years of development history, shows that only one new-field wildcat out of every 44 drilled discovers a field with as much as one million barrels of total ultimate reserves, the committee stated. Nearly 98% of all new-field wildcats drilled are failures in that they are abandoned as dry or they discover reserves too small, on the average, to be profitable.

These are the facts which have forcibly demonstrated the need and fairness of the 27½% depletion allowance, and in demonstrating this need they have been of inestimable value to the industry, to the government, and to the public at large, Dr. Lahee stated in turning his 20-year task over to his successor, Graham B. Moody, formerly vice chairman of the committee. Dr. Lahee now is engaged in consulting geological work at Dallas.

The system which Dr. Lahee's committee devised classifies all exploratory holes drilled as either (1) on structures not yet producing, or (2) on structures already producing. Holes of the first of these two classes are new-field wildcats. Occasionally, where structures are ill-defined and porosity varies considerably within relatively short distances, exploratory holes may be classified as new-field wildcats if they are two miles or more distant from the nearest production. Holes of the send class (on structures already producing) may be (1) outside the developed area (area of proved reserves) in which case they will be either (a) outposts or (b) new-pool wildcats according to whether they are drilled (a) to extend a partly developed pool (reservoir) or (b) to explore for a new pool; or (2) within the proved developed area of the pool, in which case they may be deeper-pool tests (exploring beneath the deepest known pool penetrated by the hole) or shallower-pool tests (exploring for a new pool above the deepest developed pool at the site of the well in question). There are very few exploratory holes that belong to this first class, i.e., shallower-pool tests. Most of the wells of this kind are field-development wells that happen to find new shallower pools. In other words, such holes were not drilled for the purpose of exploring for a shallower reservoir. Only rarely is such exploration undertaken, and usually where suggestions of lensing or faulting indicate that they may be a chance for a shallower accumulation.

Motor fuel of about 100 octane will be marketed for today's "hot" cars at 3-cent premium. Experiment follows close on Sun's five-grade plan being tested in Florida.

ESSO to Market Super Premium

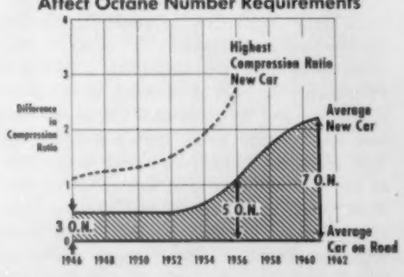
TWO disparate marketing experiments have been undertaken by major oil companies in eastern states in an effort to solve the octane dilemma at minimum cost. Sun Oil Co. is trying out a system under which two grades of motor fuel are blended in varying proportions to five different octane levels, each commanding a different price. Esso Standard Oil Co. has tackled the problem in a different manner by announcing that it will sell a third grade or super premium fuel "Golden Esso Extra" at a price three cents above Esso Extra.

In announcing its new third grade or super-premium gasoline, Esso stated that 95% of all cars now on the road are satisfied by today's average premium gasoline, whereas only 78% of 1956 cars operate perfectly on the average grade of premium fuel. With its new super grade Esso expects to satisfy the 22% of new cars not now properly fueled.

Even with the new grade Esso anticipates that the petroleum industry must make very large new investments in plant facilities to keep up with the motor makers. Under the 3-grade system it is estimated that the industry must spend 1.6 billion to produce 1961 gasoline quality whereas under a 2-grade system the cost would be $3 billion.

Esso will change to the 3-grade system in six cities by June 20 and expects to have 75% of its dealers equipped with extra pumps and tanks by mid-August. The six cities to be served first are New Orleans, Memphis, Baltimore, Washington, Boston and New York.

Compression Ratio Trends Affect Octane Number Requirements



"Hottest" 1956 car has a compression ratio 3:1 above the average car on the road and requires a gasoline five octane numbers higher than the average. Esso estimates that a differential of seven octane numbers will be required by 1961.

Esso's new fuel falls outside the 0-100 octane scale, but no precise octane number has been announced. Each plant will produce the fuel by the method or combination of methods which best fits its crude supply. In all plants there will be a large percentage of aromatics and these will be supplemented at most plants by alkylates, isomers and specially fractionated base stocks.

It is the view of Esso's engineers that the new super grade gasoline will be economic for motorists with "hot" 1956 model cars. With high aromatic content the Btu rating will be higher, tending to give greater mileage. Also it will be possible to operate the cars at optimum spark advance. Looking to the future Esso suggests that when 12:1 compression ratios are reached that cars will have a 30% greater fuel economy than with the present 8.5:1 engines. This is not to say that mileage will increase by 30%. In the past few years much of the increase in motor efficiency has been absorbed by convenience modifications and increased horsepower. In 1935 most transmissions were manual while today the automatic transmission is almost universal. Three years ago only 10% had power steering. This has grown to 28%. Power braking has grown from eight to 27% in the same time. Most important of all, average horsepower has increased 50%, from 133 hp in 1953 to 207 hp in 1956.

The change in motors built in the U. S. has been at an accelerated rate in recent years. It took 15 years for average ratios to rise from 6.3:1 to 7.4:1 and only three more years to add the next 1.1:1 to bring the average up to 8.5:1. In the 15 years from 1938 to 1953 average horsepower rose only 20, compared with 66 in the past three years. Relative fuel economy rose 18% in 15 years and an additional 14% in the past 3 years.

Esso had intended to bring out its super-fuel five years from now. The rapid change in motors forced the company to advance its date.

Technologists for the company anticipate that the trend will continue at a rapid rate in the next five years. Whereas the average new 1956 car requires a fuel five octane numbers higher than that of the average car on the road, it is expected that by 1961 this will spread to seven octane numbers. Average compression ratio of all cars on the road today is 1.1:1 lower than the 1956 average. By 1961 the differential may be 2.2:1.

It is to be assumed that Esso will change its specifications on all three grades as car appetites change. In eastern states regular research octane gasoline has been averaging about 92 research octane and premium a little under 97. Because of the longevity of old cars it is possible that regular and second premium may satisfactorily stay at about present levels for several years, with the rating of the new super fuel changed as required.

Marketers will await with interest data on the volume of the new super fuel sold in comparison with other grades—particularly after the novelty wears off. Recently premium grades have comprised from 25 to 40% of total volume, depending on area and other factors.

Sun Oil Co. began its experiment at Orlando, Florida, last February by equipping 17 dealers with specially built pumps to blend the five different grades of gasoline offered there. Because of the success at that point the experiment is being extended throughout the state. Several months will be required before all stations are supplied with new pumps and Sunoco octane concentrate since Florida is well saturated by Sun dealers.

Sun has not announced the octane rating of its five grades. Competitors have been good customers at Sun pumps recently however, and tests are being run from day to day. In general it is stated that the lowest of the five grades is about 94 research octane, in line with the company's previous single intermediate grade. The grades step up in fairly regular increments to about 101. This indicates a spread of about seven octane numbers between highest and lowest or 1.4 per grade. Cost differential between grades is 1 cent.

Sun has been unwilling thus far to give out any data on the percentage of sales by grades.

It is understood in the trade that one other major company had been planning a new top octane grade before the Esso announcement. Some others are adopting a temporary waiting attitude. Socony Mobil will continue the 2-grade system at least for the present and has stepped up the knock rating of both grades. The new regular Mobilgas R is said to meet requirements of virtually all cars through 1955. The new Special is designed to meet the needs of the new 1956 models.

Hughes bits go through on schedule

Operators know, *from long experience,* that regardless of terrain or weather, Hughes bit deliveries will be on schedule. The more than 450 members of the Hughes sales and service organization cover, *regularly,* every active drilling area in the United States and Canada.

At Hughes, however, we do more than follow the drill. Through our far-ranging representatives, working closely with the drilling industry, we determine, months in advance, the bit needs of each field and wildcat area. That's why HUGHES assures delivery of the right bits to your rig ... *ahead of time!*

Fording Peace River ... painted from actual photograph

ESSO

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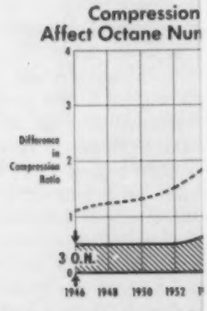

*"Hottest" 1956 car has
above the average car
a gasoline five octane
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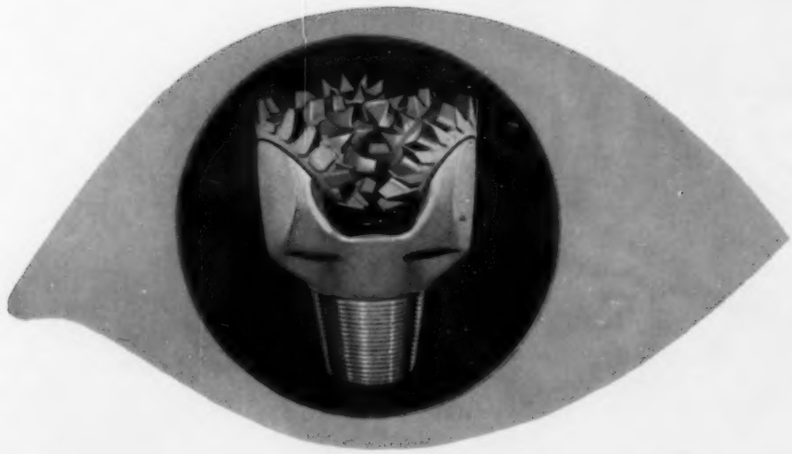
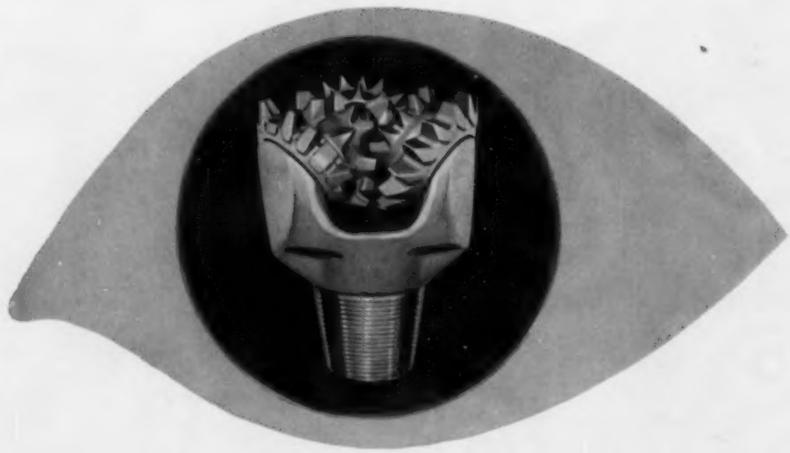
octane numbers will be*



THEY LOOK ALIKE ... but

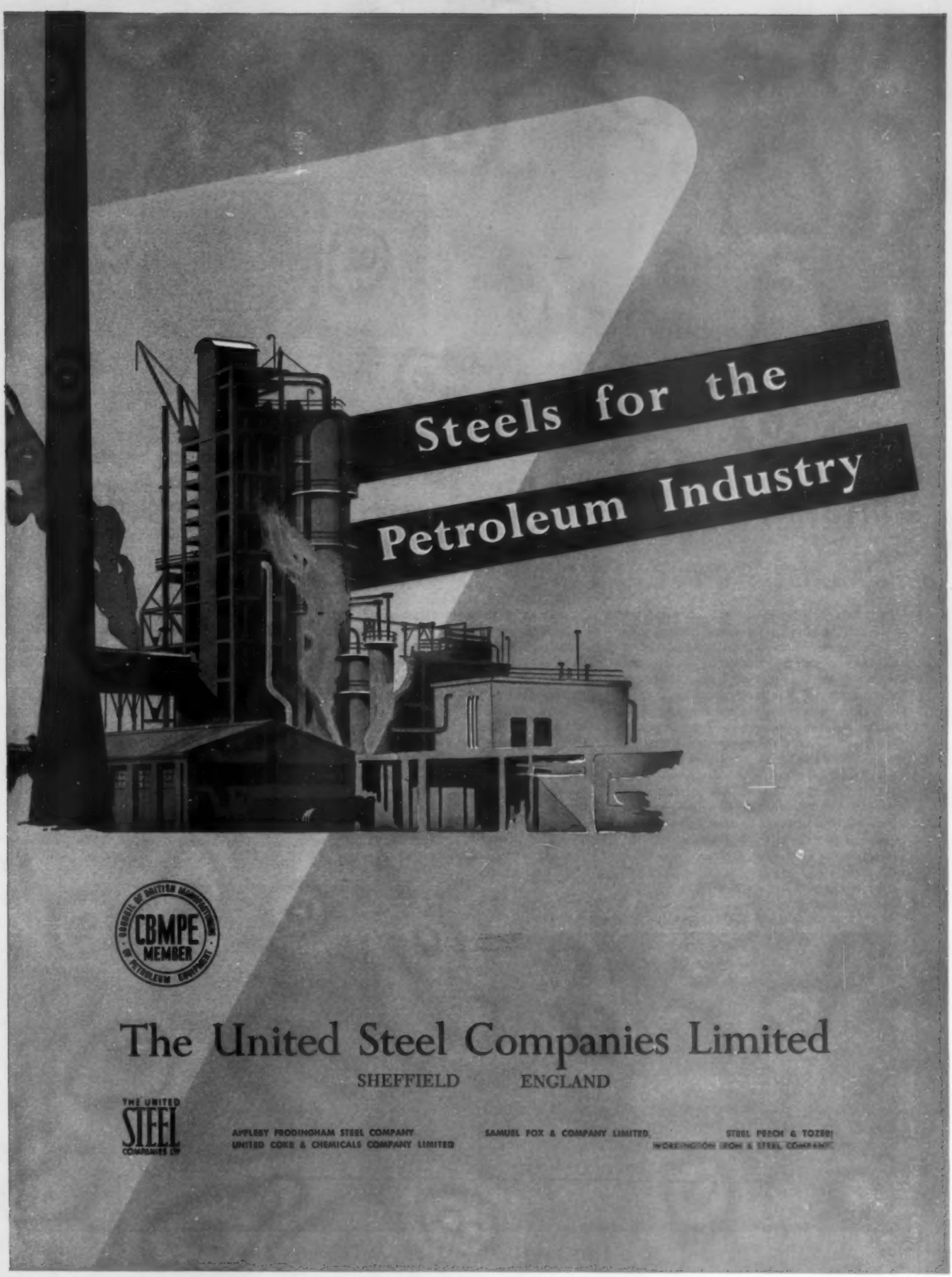


there's a difference in their performance

Looks can be deceiving. Because bits look alike is no assurance they will perform alike.

Just as an example, take the two bits pictured here. What you don't see in the second bit is the increased bearing capacity and other changes that made it a more versatile, longer-lasting, better-performing bit that makes more hole.

Back of the continuing improvement in HUGHES rock bits are unending research and experience gained in drilling millions of feet of hole each year in fields throughout the world.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Petroleum Industry
CBMPE
MEMBER
The United Steel Companies Limited
SHEFFIELD ENGLAND
THE UNITED
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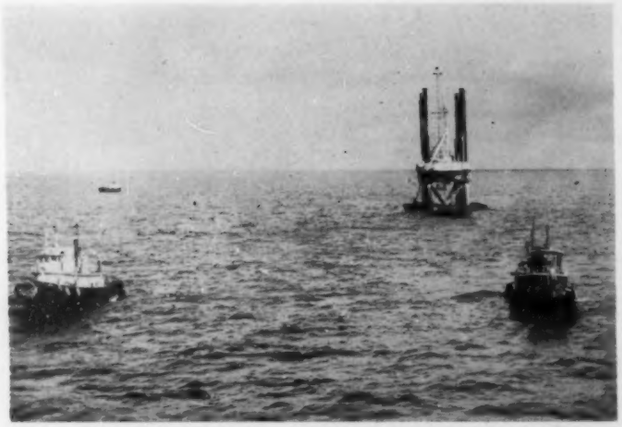
COMPANIES LTD
APPLEBY FRODINGHAM STEEL COMPANY
UNITED COKE & CHEMICALS COMPANY LIMITED
SAMUEL FOX & COMPANY LIMITED.
STEEL PEECH & TOZER



G & H Towing Company's tugs Porpoise *and* Jennifer George *towing Glasscock Drilling Co mobile platform, "Mr. Gus," to a location in the Gulf of Mexico.*

Powerful new air-conditioned 1,700 hp G & H Towing Co., Inc. tug Grampus. *The vessel is 105 feet long, has a beam of 27 feet and a draft of 14 feet.*

Higher Horsepower Tugs for Offshore Tows

TUGBOAT operators on the coast of the Gulf of Mexico are getting more calls each month. Mobile drilling platforms which now dot the continental shelf in increasing numbers require the aid of powerful tugs to reach each new location.

Towing these strange new seagoing platforms is causing expansion of the fleet and an increase in the horsepower rating of tugs over that necessary for steamer and cargo barge work.

The G and H Towing Co. of Galveston recently christened the *Grampus* at San Jacinto battleground on the Houston ship channel before nearly a thousand invited guests. The *Grampus* is one of the most powerful tugs in deep sea service. It is the first of three all-steel diesel tugs being built for G and H by Gulfport Shipbuilding Corp.

Equipped with a General Motors diesel engine rated at 1700 shaft horsepower, the *Grampus* is 105 feet long, has a beam of 27 feet and a draft of 14 feet when fully loaded with fuel, water and stores. A storage capacity sufficient for 30 days at sea will enable the *Grampus* and her sister tugs to handle towing operations to any part of the world.

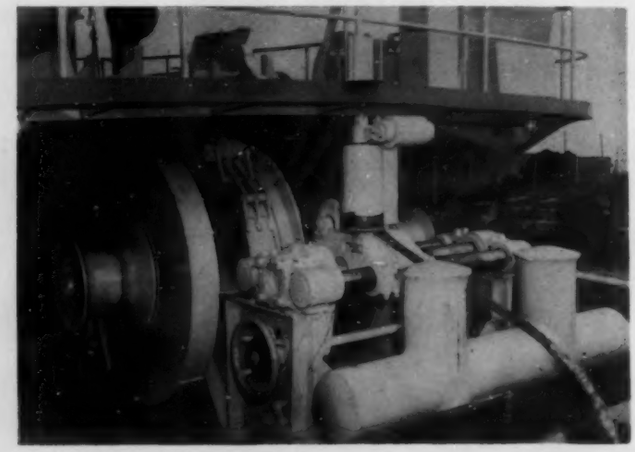
The *Grampus*, which will normally carry a crew of 11, can easily sleep 15, with three staterooms topside, four below, plus an "owners room" providing special accommodations for company executives who might accompany the towing operation. The handsomely finished quarters are completely air-conditioned.

Another feature added for offshore and deep sea service is the automatic towing engine on each of the new deep-sea boats, which carries 1,800 feet of 1¾ inch ABS approved steel towing cable. The towing engine automatically controls the tension on the towing cable giving the tug boat greater control of its tow in heavy weather.

First job assigned to the *Grampus* was to tow a disabled tanker from Lake Charles, La. to an east coast shipyard for repairs.

Engine room on Grampus, *equipped with a 1,700 hp diesel for propulsion.*

Right side of automatic towing engine on Grampus.



World's Largest Underground Gas Storage Installation

(*Continued from page 57*)

about $39 million. This does not include the largest expenditure of all, a 30-inch, 791 mile pipe line by Texas Eastern from Kosciusko, Mississippi, to Connellsville, Pennsylvania.

On the field itself was installed a compressor station costing $11 million, the largest single expenditure in the field. Other investments included field lines at $2 million, a 30-inch pipe line by Texas Eastern, extending 35 miles from the vicinity of Oakford into Fayette County, costing $3.5 million; two parallel 20-inch lines laid by New York State Natural from the new pool to the Ohio lines, a distance of about 70 miles and which cost $6.25 million. Re-drilling and reconditioning of 267 wells in the field cost $2.5 million. To these can be added about $100,000 for a district office and warehouse in nearby Jeannette. The installation now employs about 150 men, full time.

The old depleted Oakford field had been developed and abandoned about the turn of the century. It is an anticlinal structure, in which the Murrysville Sand and the Fifth Sand, have conditions favorable for storage.

In North Oakford, the Murrysville Sand accumulation of gas was due to structure. Gas was accumulated in the top of the dome; there is salt water down-dip from the gas, surrounding the producing area in its entirety. The water acts as an effective seal for trapping the gas because of the dome-like structural conditions.

Scrubbers at Oakford, designed by Fish Engineering Co.

Fifth Sand production was found on the northwest flank of this same structure at a depth several hundred feet deeper than that at which the Murrysville Sand is encountered. The Fifth Sand reservoir is an effective trap because of variable porosity within the sand itself. There is a long narrow section on the west flank of the structure in which the Fifth Sand is porous and contained gas. It is limited on every side by non-porous sand, thus comprising a closed reservoir.

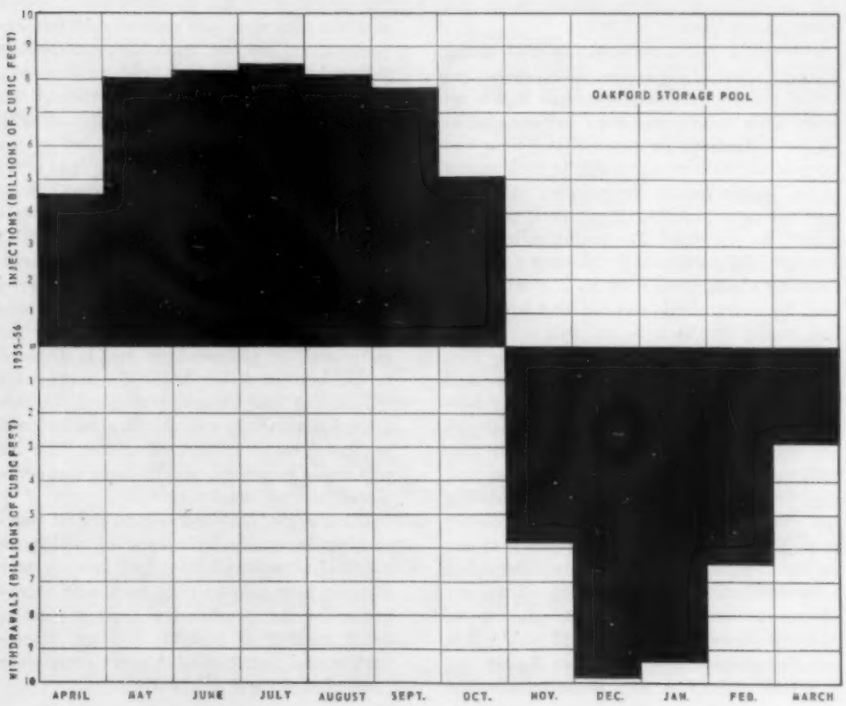
The limits for both the Murrysville trapping and for the porous portion of the Fifth Sand were amply proven by the large number of wells which have been drilled. The non-producing portions have been defined by wells which were dry in either one or the other of the two producing horizons.

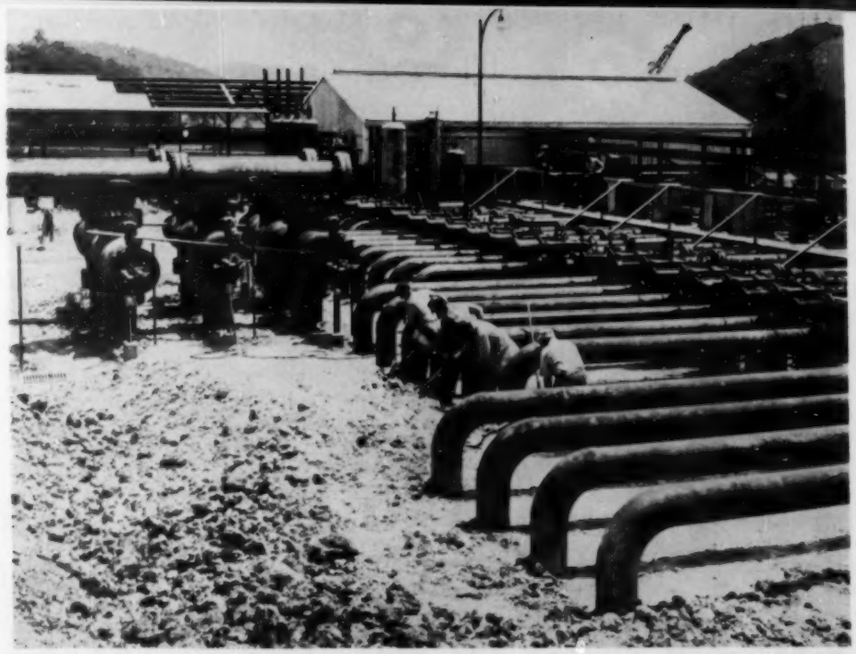
An injection of 2,400 mmcf of gas into the Murrysville Sand was made in 1937-38 which was subsequently totally withdrawn. The complete recovery of this gas was a further indication of the suitability of the area for storage.

A number of old, abandoned wells were found in the field. It was felt by the company that all wells in the proposed storage area should be reworked, whether they were to be used as actual input or withdrawal wells or not. In a pool developed and abandoned as early as Oakford, when plugging legislation was practically nonexistent, it could not be assumed that the abandoned wells were plugged adequately for the carrying on of storage operations. Within the storage limits there existed both abandoned wells and active wells.

Since there are several other producing horizons in this area, certain of the active wells had been completed to productive sands at a greater depth than the storage sand. These wells were cleaned out to their total depth and then plugged back to the bottom of the storage sand. All old casing was removed from the hole. New strings of casing were run and cemented to the surface. The wells were then equipped with new shutting-in outfits.

Abandoned wells in the area posed many difficult problems. In certain cases, actual





Meter runs during construction. There are 21 Daniel Orfice meters used, measuring flow in either direction.

locations were difficult to establish. Earth moving equipment such as bull-dozers and highlifts, and even mine detectors were used. After the hole had been located, a drilling rig was moved on the location and actual cleaning out operations started. Many such abandoned wells were found to contain lost drill bits, pieces of casing, assorted pieces of metal, and even hollowed out logs, apparently used as casing in the early drilling days. After removing all such material from the hole, the well was either properly plugged and abandoned or fitted with new casing and shutting-in equipment.

To-date, 248 wells have been reworked at Oakford as active or observation wells and 93 wells cleaned out and properly replugged to assure safe storage operations.

Several problems have been encountered in the operation of the large new underground pool. One of the most difficult problems encountered in the operation of the Fifth Sand Pool is the formation of natural gas hydrates. This problem arises when the Fifth Sand Pool is at a pressure higher than the transmission line pressure and gas is natural fed from the pool. Gas flows from 50 wells at full field pressure and is measured at one location. The gas is then heated, using a steam shell and tube heater, then passed through a pressure reducing station which cuts the pool pressure to transmission line pressure. Considerable difficulty has been experienced with freeze-offs in the well gathering lines, and even in main trunk lines before a pressure reduction. Partial close-offs have been found across line valves or where line size changes. Hydrate formation has been also encountered in the orifice runs. This problem has been controlled by covering these above ground runs with canvas and heating with steam. Where a localized freeze-off exists, alcohol is injected into the gas stream for hydrate removal. The best method of removing hydrates is to isolate the section of line and reduce the pressure for 24 hours. This solution, of course, can only be used on gathering lines or where other piping facilities exist to maintain flow.

Additional problems encountered have been reported by S. S. Galpin, production engineer, New York State Natural Gas Corp. and P. H. Montgomery, storage engineer with United Natural Gas Co. In a paper entitled "Unique Tools and Methods usesd in Conditioning Gas Wells," presented at the Spring meeting of the Eastern Division of the American Petroleum Institute Division of Production, the authors discussed the problems encountered in reconditioning the wells for storage. Once the initial problem of location of the old wells was overcome and the hole was open, it was possible to run various surveys of which the most helpful included the gamma ray, casing collar locator, section gauge and temperature logs.

According to the authors, the gamma ray log provided a stratigraphic record that could not be obtained otherwise in an old hole. This record was used for correlation of the formations penetrated, and from the correlated log it was possible to pick casing seats, locate points for packers or plugs, and set up a plugging program if the well was to be replugged. The casing collar locator, originally utilized for placing gun perforating shots, proved to be a most useful tool for determining the top and bottom of old casing in the hole, as well as finding the location of any other metal in the hole. The section gauge plotted the hole size and acted as a verification of the top and bottom of old casing strings, as well as showing any holes or collapsed areas. It also indicated the location of caved zones and shot holes, and was helpful in calculating the amount of cement needed for casing jobs. The temperature log was used to locate gas pays. Careful interpretation plus improvements in the sensitivity of the instrument eventually made it possible to pinpoint flows as small as 500 cubic feet per day at pressures as low as 8 psig.

Actual redrilling and reconditioning of wells, the authors stated, was done in a normal fashion. A joint of 10-inch or larger casing was set to prevent caving at the top of the hole. The first obstacle that was encountered was sounded out, and, if casing, was cut with a casing ripper at its lowest free point. Fishing attempts were made ordinarily with a trip spear first, followed by a bell socket if needed. Often weeks or months were required to remove a few hundred feet of pipe from the hole. Tools left in the hole were fished out with a slip or combination socket, or small objects with a cherry picker. The combination socket, was at times modified with a "skirt" made of two half rounds of the proper size pipe 18 or 20 inches long, welded to the bottom of the socket. These "skirts" were flared out to the size of the hole, and helped guide the socket over the fish where the hole had been enlarged by drilling or by caving. Not the least of the problems was the occasional fishing out of tools. One well had four strings of tools fast in it. Two strings were recovered, but the other two were abandoned in the hole.

Generally tools and methods, as described by the authors of the report, were improvised to overcome difficulties when conventional ones failed to do the job. There is little monotony connected with this type of work, according to the authors. For example, one incident occurred while drilling a storage well in the Oriskany Sand. The drilling bit became unscrewed from the tools and was left at the bottom of the hole. With an open flow of approximately 12 million cubic feet daily, a friction socket was run into the hole to fish for the lost bit. As the tools were pulled to the top of the hole, the jars were held in a closed position by the gas pressure behind them. When the bottom of the socket came out of the casing, some gas pressure was released and the jars suddenly opened and the impact caused the lost bit, which was held in the socket by a friction hold, to drop out. Instead of dropping to the bottom of the hole, the bit floated in the gas stream with about one foot of it above the top of the casing. The bit was held there by gas pressure which had backed up behind it. It bobbed up and down there for approximately one-half minute. Before the bit could be removed, it slowly settled down just below the top of the casing and stayed there for several minutes. Efforts to remove it failed. Suddenly the weight of the bit overcame the gas pressure and it dropped to the bottom of the hole. The force with which the bit struck the sand further drilled the well in and the flow of the well increased to 15 million cubic feet. The bit was never recovered, and the hole was completed in that condition.

The story of Oakford is a record of engineering ingenuity by means of which an old field abandoned for a half century was given a new role to play as a safe storehouse for gas produced a thousand miles away making it possible for gas transporters and distributors to serve consumers more cheaply and efficiently.

Another Example of Efficient Power at Lower Cost

The enormous Oakford underground storage project is a joint development of the New York State Natural Gas Corp. and the Texas Eastern Transmission Corp. In this modern station, a total of twelve gas-engine driven Cooper-Bessemer GMW's develop 30,000 hp for the pressuring of natural gas.

For the world's largest Natural Gas Pool...

12 Rugged GMW's at Oakford Storage

At Delmont, Pa., the Oakford compressor station and underground pool boasts a storage capacity of 105 billion cubic feet of gas . . . largest in the world.

Used for pressuring Texas gas into storage, and returning it to the system as needed, are twelve Cooper-Bessemer GMW's totalling 30,000 dependable compressor horsepower. The extreme flexibility of these big 2500 hp V-angles is the perfect solution to the complicated set-up at Oakford storage. Here, GMW's easily and efficiently handle many variations and combinations in pressure requirements from 50 to 1500 psi.

When you think of heavy-duty compressor service, think of Cooper-Bessemer V-angles, and remember the advantages — outstanding availability, unmatched flexibility, low cost of operation, minimum maintenance and unusual compactness. Reliable V-angles are available in sizes from 200 to 3000 hp. For complete information, contact the Cooper-Bessemer office nearest you.

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Review of U.S. Patents on Petrochemicals

by Heinz Heinemann and Harold Shalit

The current review is concerned with olefins, their production, purification and reactions. The last review devoted to petrochemicals (World Petroleum, October, 1955) discussed the polymerization of unsaturated compounds, so that this subject will not be covered now. Olefins constitute a very important source of chemicals and their availability by conversion of petroleum charge stocks is a large factor in the development of the petrochemical industry. There is great activity in this field as evidenced by the 40 patents discussed in this review, which, as stated, does not cover polymerization, the most actively investigated of the reactions of unsaturated compounds. All of these patents have appeared since the subject was last reviewed in the April 1955 issue of World Petroleum. Among the reactions of olefins, those treated by the largest number of patents are the "Oxo" reaction, the oxidation to epoxides and glycols, and the alkylation of phenols. The manufacture and purification of acetylene will be discussed in an early issue.

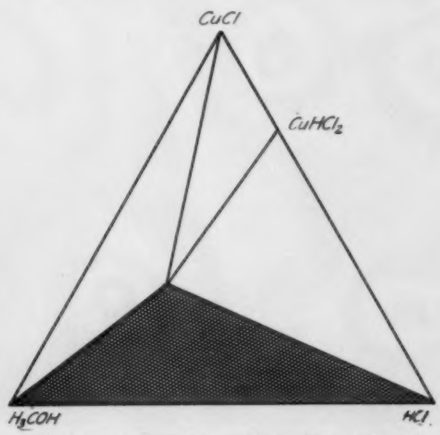
Production and Purification—Most of the low molecular weight olefins from petroleum are made by catalytic or thermal cracking of petroleum fractions. However, for certain specialized olefinic types, more specific preparative methods are needed. In two patents assigned to Imperial Chemical Industries, Ltd., H. W. B. Reed discloses a method and catalysts for the production of cycloolefins with at least eight carbons in the ring. In 2,686,208 the cycloolefins are made by contacting conjugated diolefins, or alkoxy derivatives, and acetylene at 15 atmospheres and 80°-150°C with a nickel carbonyl catalyst containing, in lieu of at least one CO group, a compound of nitrogen or phosphorus, e.g. $([C_6H_5]_3P)_2$ Ni $(CO)_2$. Preferably, a dehydrating agent such as calcium carbide or ethylene oxide, is present together with a polymerization inhibitor. The acetylene may or may not be included in the product; thus, for example, butadiene is dimerized to cyco-octa-1,5-diene and some 4-vinyl cyclohexene. Isoprene reacts with acetylene to give 1-methylcyclooctene. In 2,686,209, a similar reaction is proposed using as catalysts compounds of the formula $[(RO)_3P]_xNi$ $(CO)_{4-x}$, where x is 1 or 2. With this latter catalyst acetylene is not necessary, but if it is used higher yields of 12- and 16-carbon ring compounds are formed.

H. V. Hess and N. D. Carter (2,735,876 to the Texas Co.) outline conditions for the pyrolysis of gaseous hydrocarbons to ethylene and aromatics with maximum conversion and minimum production of aromatics at the expense of ethylene. The pyrolysis is a combination of cracking and soaking under critical conditions as follows: gases, preheated to 800°F, are introduced into nickel-free chrome steel cracking tubes having an area/volume ratio of 200 ft. ^{2}/ft^3 at 50 psi and 0.5-2 second contact time. During passage through the tube the temperature of the gas is raised to 1350°-1550°, and is allowed to cool in 10-4 seconds to 1100-1350° in a soaking section.

For subsequent use etheylene must be quite pure, so that it is necessary to separate it from by-products formed during its manufacture. A highly selective solvent for olefins over paraffins is claimed by A. W. Francis (2,735,878 to Socony-Mobil Oil Co., Inc.). It consists essentially of cuprous chloride and anhydrous hydrogen chloride dissolved in methyl alcohol. J. C. Elgin in 2,736,756, assigned to Phillips Petroleum Co., patents a process for the recovery of ethylene from its mixtures with ethane, methane and H_2. The gases are compressed, absorbed in a C_6-C_9 paraffin, and the ethylene extracted with nitromethane or acetontrile. The ethylene rich gases obtained from these rich solutions are purified by absorption in o-anisidine-cuprous salt solutions.

Olefinic petroleum streams sometimes contain minor amounts of diolefins, which contaminants interfere with subsequent reactions of the olefins. E. J. Hoffmann and E. F. Wadley in 2,638,438 to Standard Oil Development Co. have patented a process for selective hydrogenation of diolefins in a naphtha containing mono-olefins. This is accomplished by adding to the naphtha 0.1-1% of a caustic soluble, organic sulfur compounds (mercaptans of one to four carbons, and thiophenols) and then hydrogenating in the presence of a sulfur resistant catalyst. The product is then washed with caustic to remove the sulfur compound.

The Oxo Process—Eleven patents discussing the Oxo Process are reviewed here. A Standard Oil Co. (Indiana) patent (2,638,487 to L. W. Russum and R. J. Hengstebeck) claims improved production of higher alcohols from olefins with 3-15 carbon atoms



A. W. Francis separation of olefins from hydrocarbon mixtures and solvent therefore. Patent 2,735,878.

per molecule by treating them with a 1:1 molar mixture of CO and H_2 in the presence of an oil soluble cobalt salt. The conditions are 2500-4000 psig and 250-400°F. Special provisions are specified for removing the exothermic-heat of reaction and for recovering the catalyst. In 2,638,488, also assigned to Standard Oil Co. (Indiana) by W. J. Cerveny, conditions are laid down for the hydrogenation of Oxo aldehydes. The cobalt catalyst is first removed from the aldehydic products which are then contacted with a cobalt on pumice catalyst (containing 3-15% cobalt) together with H_2 containing 0.2-3% CO, which is enough CO to inhibit hydrogenation of olefins and of alcohols to paraffins. This hydrogenation step takes place at 450-550°F, 850-3000 psi, 0.2-1 LHSV, and at least 20 ft.^{3} of H_2 per gallon of aldehyde containing stream. An alcohol fraction is separated by distillation and is hydrogenated with H_2 containing less CO than that used in previous step.

J. K. Mertzweiller and P. T. Parker (2,641,613 to Standard Oil Development Co.) suggest an improvement of the usual Oxo process carried out with olefins, CO, and H_2 at elevated temperatures and 2000-4000°F to produce aldehydes. The improvement consists in the use of a catalyst comprising an inorganic cobalt salt dissolved in the first stage carbonylation product (aldehydes or alcohols) and solubilized by an alkyl ether of ethylene glycol.

Several patents have as an object removal of metal carbonyls from Oxo products to avoid contamination of the subsequent hydrogenation catalyst. W. J. Cerveny in 2,686,206 (to Standard Oil Co. of Indiana) proposes that olefins, with 3-12 carbons, H_2, and CO be contacted at 100-250°C and 50-250 atmospheres with an aqueous cobalt compound which forms cobalt carbonyl under reaction conditions. The aldehydic product is steam distilled from acid solution whereby the cobalt carbonyl is converted to a water soluble salt and the metal-free aldehydes are taken overhead. The cobalt solution is recycled to the formylation step and the aldehydes are hydrogenated to alcohols at 10-100 atmospheres and 100-250°C. B. H. Gwynn of the Gulf Research and Development Co. in 2,701,797 states that oxo aldehydes contain cobalt carbonyl catalyst as well as carbonyls of Fe, Ni, Cr, and Mo from pipes, vessels, etc. The cobalt may be recovered from the product by introducing steam into the products in amounts sufficient to heat them to the decomposition temperature of cobalt carbonyl (165-212°F) but below the decomposition temperature of the other carbonyls. The cobalt is separated and more steam is introduced to the decomposition temperature of the other metal carbonyls (340-420°F) causing the separation of these metals from the liquid product. A. G. Anderson and B. H. Gwynn (2,731,501 to Gulf Research and Development) demetallize Oxo product by passing the product at 25-500 psig and an initial temperature below the decomposition temperature of the least stable carbonyl through a packed demetallizing zone. Counter-current to the product stream, a gaseous mixture of steam and inert gas is charged in amounts sufficient to heat the liquid product to the decomposition temperature of the most stable metal carbonyl. The demetallized product is then separated from the water.

The aldehyde hydrogenation step is, also, the subject of 2,709,714 to J. K. Mertzweiller of Esso Research and Engineering Co. The charge olefins to an Oxo process often contain sulfur compounds which eventually cause poisoning of the aldehyde hydrogenation catalyst. Mertzweiller proposes the use of a sulfur resistant catalyst, e.g. molybdenum sulfide on charcoal, in the hydrogenation step.

W. Reppe and M. Heintzeler (2,731,504 to Badische Anilin-und Soda-Fabrik, Akt.) disclose a modification of the process for making alcohols from olefins, CO, and water in the presence of alkaline compounds and metal carbonyls. Their improvement comprises heating an olefin above 80°C at pressures above 50 atmospheres, in water of neutral to alkaline reaction, with a soluble formic acid salt as a source of CO, and in the presence of ion carbonyl.

R. E. Brooks and R. C. Schreyer (2,644,844 to E. I. du Pont de Nemours and Co.) synthesize a branched chain heptadecyl alcohol by reacting CO, H_2, tetraisobutylene, and methyl acetate at 255-275°C, 325-1500 atmospheres, and in the presence of dissolved cobalt acetate as a catalyst. The products are methanol and the acetate of a branched chain primary heptadecyl alcohol. The alcohol is obtained by subjecting the ester to methanolysis. Octyl alcohols are produced in increased yields according to 2,731,-503 (W. J. Mattox to Esso Research and Engineering Co.). A mixture of hexene and heptene is obtained by polymerization of gaseous olefins (free of isobutylene). The hexene-heptene mixture is carbonylated to produce heptaldehydes and octaldehydes which are then hydrogenated to the respective alcohols. Heptyl alcohol is separated by fractionation, converted to heptene with predominantly terminal unsaturation, and then recycled to the carbonylation reaction to produce C_8 aldehydes.

A method and apparatus for controlling the temperature in olefin carbonylation is disclosed in 2,711,429 (J. B. Harding, C. A. C. Petrie to Imperial Chemical Industries, Ltd.). The apparatus provides means for indirect heat exchanging the reacting substances with a gas essentially the same as the reacting gas. The gas so heated is mixed with recycle gas and make-up gas and recycled in part to the reaction zone.

Oxidation of Olefins—Six patents dealing with this subject are reviewed, four of which are concerned with ethylene oxide production. J. F. Skelly (2,649,-

(*Continued on page* 90)

BP FUELS NORWAY'S FISHING FLEETS

THESE NORWEGIAN fishing boats are often out in the fishing grounds for weeks on end, covering many hundreds of miles during their stay at sea. On their return to their home fiords, the catch is landed, nets are repaired, and at places all along Norway's coasts BP oil fuel is pumped into the boats' fuel tanks.

The BP Shield is a familiar sight from the Arctic to the Antarctic. At sea, on land and in the air, BP makes an ever-growing contribution to the work and well-being of mankind.

The BP Shield is the symbol of the world-wide organisation of

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London Letter

By E. Lawson Lomax

The total production of coal in the U.K. in 1955 was 221.6 million tons. In "Investment in Coal" produced by the National Coal Board it is stated that during the past 5 years £350 million has been spent and over the next 10 years a further £1,000 million with a labor force of 67,000 will be required to produce a total of 240 million tons deep mined coal in 1965, with open cast mining remaining at about 10 million tons per year.

At the present time the energy consumption in the U.K. is equal to about 250 million tons coal equivalent, of which about 12% or 30 million tons coal equivalent is supplied by oil.

During the post war years, energy consumption has increased in the U.K. at a rate of 2.4% per year, and it is expected to be about 310 million tons coal equivalent by 1965.

According to the Coal Board figures about 240 million tons will be provided by coal, leaving 70 million tons coal equivalent to be provided by oil or by atomic power. Assuming that 10 million tons coal equivalent can be supplied by atomic energy, this leaves approximately 60 million tons coal equivalent to be supplied by fuel oil, about 40 million tons of oil in 1965.

In the past, in the U.K. the endeavor was to make as large a percentage of the high value products as was practical, boiler fuel oil being the lowest priced product was made in the minimum quantity. The price question is however changing, and this is to a large extent influenced by the high price of coal.

Higher coal prices in the future seem inevitable in view of the further capital of £1,000 million required over 10 years to produce an increase in coal equivalent of about 18 million tons. This capital will have to be provided outside the industry, whereas the petroleum industry will be providing an increase of 30 million tons coal equivalent or 20 million tons of fuel oil, at an estimated capital cost of £800 million; (it is estimated that it cost £40 in capital equipment to produce one ton of oil per year), and this sum will in the main be provided by the petroleum industry without resource to outside capital.

Trinidad Leaseholds Ltd.

The name, Trinidad Leaseholds Ltd., is being changed to The Trinidad Oil Co., Ltd. In view of the difficult situation which has arisen between the petrol companies and the members of the Motor Accessories Manufacturers' Assoc., of which C. C. Wakefield & Co. Ltd., is a member, L. W. Farrow, Wakefield chairman, has resigned as a director.

Trinidad Petroleum Development Co.

The directors of Trinidad Petroleum Development Co., Ltd. have declared an interim dividend on the ordinary stock of 5% (3d. per 5/-unit) free of income tax, on account of the year ending 31 July, 1956. (Last year 3¾%-2.25 pence per 5/-unit, free of income tax.)

London & Thames Haven Oil Wharves, Ltd.

Directors of London and Thames Haven Oil Wharves, Ltd. have recommended a final 1955 dividend of 12½%, less tax (1954-12½%). An interim dividend of 5% less tax (1954-5%) was paid last November.

Profit for the year was £271,525 compared with £251,741 in 1954. Transfer to general reserve was £45,500 compared with £12,500 in 1954.

The profit of the French Company (Compagnie Industrielle Maritime) was Fcs. 158,160,000 compared with Fcs. 132,010,000 the previous year. Appropriation to reserve with Fcs. 18,084,00 compared with Fcs. 11,900,000. Dividend recommended is Fcs. 180 per share, tax paid, equivalent to 17.5% less tax compared with 15%, less tax in 1954. The participation of London and Thames Haven Oil Wharves, Ltd., in the proposed dividend will be included in its accounts for 1956.

New Exploring Company

Brantly-Morrison International Drilling Ltd. has registered with a nominal capital of £100,000 in £1 shares. Its objects are to hold concessions, explore and drill for petroleum in all parts of the world, to refine, sell and distribute petroleum, and to construct and deal in all types of facilities and equipment associated therewith. It is reported that no particular areas have been selected for drilling and that the company will be financed from U.S. as well as U.K. sources. The three permanent directors are British—Andrew Morrison (civil engineer), Wm. Henry Gordon Roach (engineer), and Donald Homes. Registered offices of the new company are 27 Ashley Place, London, S.W.1.

I.L.O. Petroleum Committee

The Petroleum Committee of the International Labor Organization met at Geneva in April to discuss contract labor and human relations in the petroleum industry. Guildhaume Myrddin-Evans, deputy secretary of the Ministry of Labor, attended as chairman and representative of the governing body of the I.L.O.

The U.K. government was represented by A. M. Morgan and J. A. Beckett. The employers' representatives were R. H. Southall, National Oil Refineries; and M. W. Guinaess, Shell Petroleum. The worker's representative was H. R. Nicholas, Transport & General Worker's Union.

F. Perkins, Ltd.

F. Perkins, Ltd. of Peterborough has reported a net profit of £828,759 in 1955. A 10% dividend totaling £149,500 was proposed.

B.P.'s Film Show

On April 25, more than 14,000 stockholders and friends of the staff of British Petroleum Co. Ltd., and its associate companies, attended identical film shows at eight of the major cinemas in London, which were booked in the morning specially for the occasion. The films shown were: "We Found a Valley" which deals with the building of the Aden refinery; "Speed the Plough" a cartoon on the historical development of mechanical farming; and "The New Explorers," which depicts the company's world-wide search for oil.

New Home for Institute

The Institute of Petroleum has taken a 99-year lease on the property at 61 New Cavendish Street, London, W.1., to serve as Institute headquarters. Permission has been obtained to remodel the building to suit the new tenants. The building itself is a fine example of the work of Robert Adam built in 1770 and will lend itself well to alteration.

Plans for an Institute headquarters building first were advanced in 1939 by Lt. Col. Auld, present president, and the late Lord Cadman. The project was laid aside because of the war.

Purchase of the leasehold and necessary repairs and alterations will cost about £80,000. For this purpose the Institute's reserve of £20,000 has been allocated and it is anticipated that members will contribute further sums. Checks for the "Building Fund" should be sent to the General Secretary, Mansion House, Great Portland St., London, W.1.

Shell Exports of Materials and Equipment

During 1955, materials and equipment to the value of £40 million were exported from the U.K. by the Royal Dutch/Shell group of oil companies. This sum compares with £31 million in 1954, and represented 1.1% of the total U.K. exports.

In addition £10 million was spent on plant and stores for the U.K. refineries and £18.5 million on construction, repair and supplies for the tanker fleet.

These export orders were shared by a total of over 4,000 U.K. suppliers. The amounts placed with various suppliers naturally varied very widely, six received business to the value of over £1 million each, 75 to the value of over £100,000 and of the rest some 3,500 suppliers received orders of under £5,000 each.

J. H. Buscombe

Appointed Director

J. H. Buscombe, general manager, finance and accounts, has been appointed a director of Shell-Mex and B.P. Ltd. upon the retirement of F. A. Keeling. He has assumed responsibility for the financial and accounting affairs of the company.

Mr. Buscombe, a graduate of London University, served throughout the war in the Royal Naval Volunteer Reserve, attaining the rank of Lt. Comdr. On demobilization he joined the Royal Dutch/Shell Group. He became assistant to the head of the finance administration in London on its formation in 1953. He joined Shell-Mex and B.P. as general manager, finance and accounts in 1954.

Melchett Medal Presentation

Prof. Sir Alfred Egerton, F.R.S., was honored for his contributions to the science of fuel production and utilization at the April luncheon of the Institute of Fuel. R. H. Gummer, president of the Institute, presented the Melchett Medal for 1956 to Prof. Egerton.

Principal guest at the luncheon was R. P. Morrison, independent chairman of the British Iron and Steel Federation. In his reply to the president's toast to guests Mr. Morrison stated that the iron and steel industry employs fuel oil to produce a third of its output despite the disadvantages of sulfur in the fuel.

Tanker News

The motor-tanker "Tank Duchess" of 20,000 dwt, built by Fredriksstad M.E.K. Verksted to the order of Sigurd Herlopson & Co. A/S, Oslo, was launched on Mar. 21, 1956.

Vickers-Armstrongs (Shipbuilders) launched an 18,000 dwt M.V. oil tanker for Shell Tankers, Ltd. on Mar. 28.

This vessel is destined for service with Shell Bermuda Overseas Co.

The Blythswood Shipbuilding Co. Ltd., launched the screw steam turbine driven 22,500 dwt oil tanker "Atlantic Knight" on April 26 for Ocean Tanker Line, Ltd., Monrovia.

Harland & Wolff Ltd. launched the 18,000 dwt turbine driven oil tanker "Harvella," for Shell Tankers Ltd. on April 26.

Harland & Wolff has delivered the 32,000 dwt oil tanker S.S. "Elin Knudson" to Knut Knutsen O.A.S. Haugesund, Norway, after the successful completion of sea trials.

Personnel

Commodore William Alexander Michie has retired from the British Tanker Co., the shipping organization of The British Petroleum Group.

Commodore Michie commenced his seagoing career at the age of 16 as a navigating apprentice. After service as a junior officer in the merchant navy during World War I, he joined the British Tanker Co. in 1918. He received his first command in January 1928 and during World War II was serving at sea as master in a number of the company's ships. He was made one of the Company's senior post masters and in 1954 he was appointed commodore of the company's fleet, his last command being the 32,000 dwt tanker S.S. "British Engineer."

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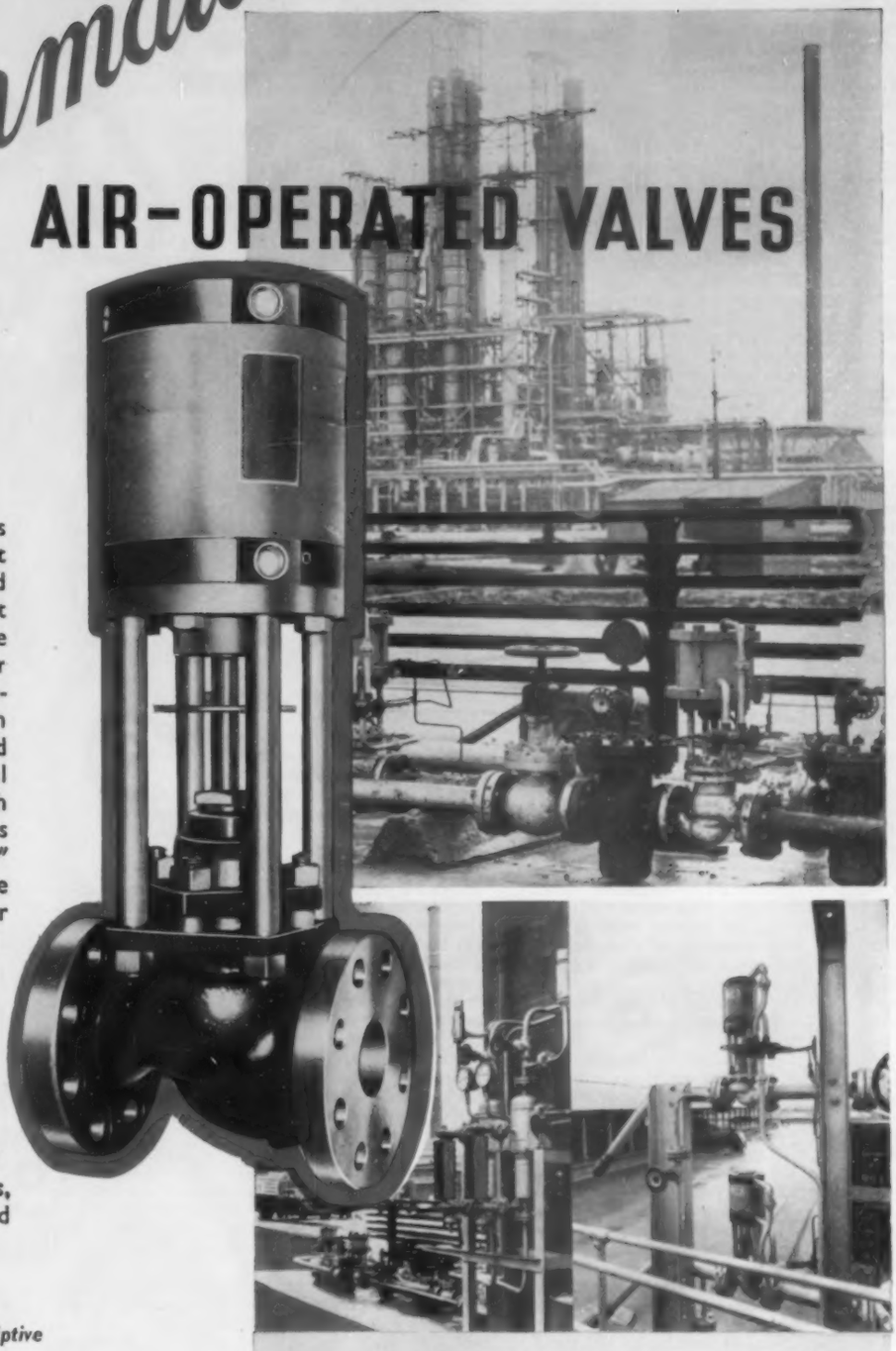

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Review of U.S. Patents on Petrochemicals

(*Continued from page 86*)

463 to M. W. Kellogg Co.) produces olefin oxides by contacting an olefin containing gas in a first contact zone with a halide of Cu, Pt, Pd, Ir, Al, Zn, Ag, Hg, or Sb at 30-150°F. The olefin coordination compound thus formed is oxidized in a second zone at 400°-1000°F. According to A. S. Brengle and H. R. Stewart (2,709,173 to California Research Corp.) ethylene is oxidized with an oxygen containing gas to produce ethylene oxide by contacting the gaseous reactants at 300°-750°F, space velocities of 150-3300 gas volumes/volume catalyst/hr with a modified silver containing catalyst. The modifications consist in the incorporation in the catalyst of barium peroxide (2-15% of the amount of silver) and Li Br (0.001-0.1% by weight of the silver). The whole composition is deposited on an alumina carrier. In a fluidized process for making ethylene oxide disclosed in 2,713,586, G. Calingaert of the Ethyl Corp. passes ethylene and an oxygen containing gas at 150-400° over a silver oxidation catalyst supported on a magnesium aluminate spinel. The particle size distribution of the catalyst is specified as 30-40 parts between 100-200 mesh, 30-40 parts between 200-325 mesh, and 10-75 parts smaller than 325 mesh. L. J. Beckham of Allied Chemical and Dye Corp. in 2,734,906 proposes to increase the efficiency of ethylene oxidation to ethylene oxide by depressing hot spots in the silver catalyst bed, resulting in a more uniform temperature. Beckham accomplishes this end by adding to the ethylene-oxygen mixture a halogenated polyphenyl compound boiling in the range 435-450°C, e.g., 2,4,6-tribromobenzophenone, in amounts less than 10 parts per million of gas mixture.

Oxidation of olefins to glycols and their esters is claimed by J. C. Snyder of Houdry Process Corporation in 2,701,813. The glycols are produced by partial oxidation of olefins with an oxygen containing gas in the presence of cobalt acetate and at least three moles of acetic acid per mole of olefin. Recommended temperatures are 50-250°C with enough pressure to maintain the liquid phase. Polyhydroxyl compounds are also produced according to the claims of 2,731,502 assigned by C. W. Smith to Shell Development Co. According to this patent, polyhydroxy compounds with the hydroxyl groups on adjacent carbons are obtained by oxidizing olefins with H_2O_2 at 0-100°C in the presence of 1-20 mole % (based on olefin) of an organic sulfonic acid chosen from the group consisting of aliphatic sulfonic acids with 1-18 carbons, and aromatic sulfonic acids with 6-24 carbons.

Hydration of olefins—Alcohols are produced by the addition of water to an olefin and this important reaction is the subject of three patents reviewed here. E. W. Carrier (2,648,711 to Standard Oil Development Co.) makes ethanol or isopropanol free of the corresponding ethers by direct hydration of ethylene or propylene with steam at 150-375°C and 500-3000 psi in the presence of an acid catalyst, e.g. H_2SO_4,H_3PO_4. The product containing alcohol, ether, and unreacted olefin is passed without reduction of temperature or pressure to an intermediate point of an extractive distillation column. In the column, a reflux is maintained with a water content of 65-99%. The bottoms from the column constitute an aqueous solution of alcohol free of ether. In 2,678,332, D. W. Cottle of Standard Oil Development Co. performs the olefin hydration simultaneously with an esterification to produce esters. His process consists in reacting an olefin and a carboxylic acid, each having from 2-12 carbon atoms, in the presence of a solid, acidic cationic exchange resin free of water. The reaction is performed at 80-120°C and in the liquid phase. H. O. Mottern of Esso Research and Engineering Co. states in his patent, 2,729,682, that, when propylene is hydrated to isopropanol, sulfur bearing impurities in the olefin feed cause odors in the finished alcohol purified by water extractive distillation. According to Mottern the odor may be eliminated by incorporating into the propylene feed to the hydration 0.5-5.0% C_4-C_5 mono-olefins. The higher olefins react with the odor causing impurities, and the products of this reaction are removed overhead in the subsequent extractive distillation in which isopropanol is concentrated in the bottoms.

Aromatic Alkylation reactions with olefins—An important reaction of olefins is the alkylation of aromatic compounds, usually acid catalyzed. Three patents are concerned with the alkylation of phenols. In 2,732,408 (assigned to California Research Corp.), J. K. Foote prepares t-octyl phenol by reacting substantially anhydrous phenol with anhydrous diisobutylene. The reaction is carried out at 30-90°C in the presence of an acid activated clay of moisture content between 0.5-5 wt.%. It is claimed that controlling the catalyst moisture content is important for increasing the yield. An Imperial Chemical Industries, Ltd. patent (2,733,274 by C. T. Y. Cowie) claims the production of methyl di-t-butyl phenols by alkylation of m-and p-cresols with isobutylene. The reaction is performed at 20-50°C in the presence of a cresol sulfonic acid catalyst until two moles of isobutylene are taken up. Control of the temperature range is important in minimizing the formation of mono-alkylate and butylene polymer. A continuous process for alkylating phenol is claimed in 2,739,172 by T. J. Peters of Esso Research and Engineering Co. The process comprises reacting phenol with a tertiary olefin containing 6-16 carbons by introducing a premixed feed of olefin/phenol ratio between 0.95 to 1.2 into a reaction zone containing alkylated phenol. Gaseous BF_3 as a catalyst is continuously charged to the reaction in amounts equal to 0.9-1.5 wt.% of the phenol. The reaction takes place at 50°-100° in a medium of alkylated phenol containing a complex of BF_3-alkylated phenol.

Three patents are concerned with the alkylation of aromatic hydrocarbons. Thus, G. E. Langlois (2,713,600 to California Research Corp.) lays down conditions for the reaction of aromatics, up to xylenes, with propylene in which improved utilization of the aromatic hydrocarbon is claimed. He operates at 200-1800 psig and 300°-400°F in the presence of a liquid, non-adsorbed phosphoric acid catalyst of a concentration at least 96% but not above 104% based on ortho phosphoric acid. A recycle process for manufacture of p-diisopropyl benzene is described by N. Max and Y. Schaafsma in 2,730,557, assigned to Shell Development Co. Their process comprises catalytically cracking an alkylate and separating from the cracked product a fraction which is essentially cumene. The cumene is then alkylated with propylene, the alkylate fractionated, and p-diisopropyl benzene separated. The other isomers are cracked in the presence of at least 50% diluent gas at 300-425°C under conditions where little conversion to benzene, ethylene, and butenes is obtained. The cracked products are then recycled to the alkylation zone. In 2,737,536 by H. S. Bloch and G. L. Hervert to Universal Oil Products Co. the olefin is not used as an alkylating agent but rather to accept hydrogen from a paraffin hydrocarbon which then alkylates an aromatic hydrocarbon. This chain of events takes place when an aromatic hydrocarbon, a paraffin with a tertiary carbon atom, and an olefin with three carbons more than the paraffin are mixed an acidic alkylation and hydrogen transfer catalyst. It is recommended that the aromatic be present in molar excess.

Miscellaneous reactions of olefins—These patents are not classified as to subject, but are treated in numerical order. Occording to H. de V. Finch and K. E. Furman (2,635,119 to Shell Development Co.) olefins with at least three carbons are converted to ketones by treatment with water at 200-500°C and 150-2000 psi. The catalyst used is a sulfide by Mo, W, Te, or Se mixed with 0-40 mole % of a sulfide of Ni, Fe, or Co.

Nitriles are made from olefins and NH_3 according to 2,643,266 by J. W. Teter to Sinclair Refining Co. The olefins and NH_3 are reacted at 640°F, 1500 psi, and 0.26 liquid hourly space rate over a catalyst comprising pellets of cobalt oxide on diatomeceous earth. The pellets should have an apparent bulk density between 0.75 and 1.3, a surface area in excess of 120 m^2/g, a sodium content not exceeding 1%, and contain not more than 2% sulfate, and not more than 0.1% chloride.

In 2,652,429 assigned by H. D. Hartough, J. J. Dickert, and S. L. Meisel to Socony Vacuum Oil Co. an olefinic petroleum fraction, formaldehyde, and an ammonium halide (not including fluoride) are reacted to prepare basic nitrogenous derivatives and m-dioxanes. The reaction takes place at 50°-150°C.

In 2,712,554, W. T. Meller claims the preparation of halogenated carbonyl compounds by reacting ethylene, substituted with at least one halogen and containing not more than one hydrogen, with oxygen in the presence of fluorine.

In a process for making saturated C_8-C_{30} alcohols M. Erchak of Allied Chemical and Dye Corp. (2,713,071) reacts ethylene and a saturated monohydroxyl alcohol with not more than eight carbons. The reactants are contacted at 1000-5000 psi and 220°-340°C with H_2O_2 as a catalyst. The alcohol to ethylene ratio should be between 1 and 6 and the H_2O_2 should be present in 0.1 to 3 parts by weight per 100 parts of low molecular weight alcohol.

Silicones are important products, and J. P. West of Universal Oil Products claims to have discovered a way to improve their insulating, waxing, and water repellent properties. In 2,716,128 he reacts an olefin with a polyalkyl substituted polysiloxane in the presence of a free radical catalyst at temperatures at least as high as the decomposition temperature of the catalyst. Compounds suitable as catalysts are organic peroxides, hydroperoxides, peroxyesters, metal alkyls, etc.

W. E. Garwood and L. A. Hamilton of Socony Mobil Oil Co. propose a method for alkylating yellow phosphorus with olefins in 2,731,458. The products are organic phosphorus compounds having the properties of a tertiary-phosphine and of a weak acid, and in addition, they have P-P linkages. In this process olefins, yellow phosphorus, and an organic peroxide in the relative proportions of 1:0.001:0.001 to 1:1:1, respectively, are reacted at 20-250°C and in the absence of oxygen.

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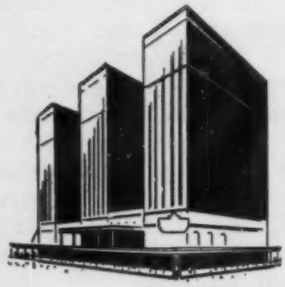

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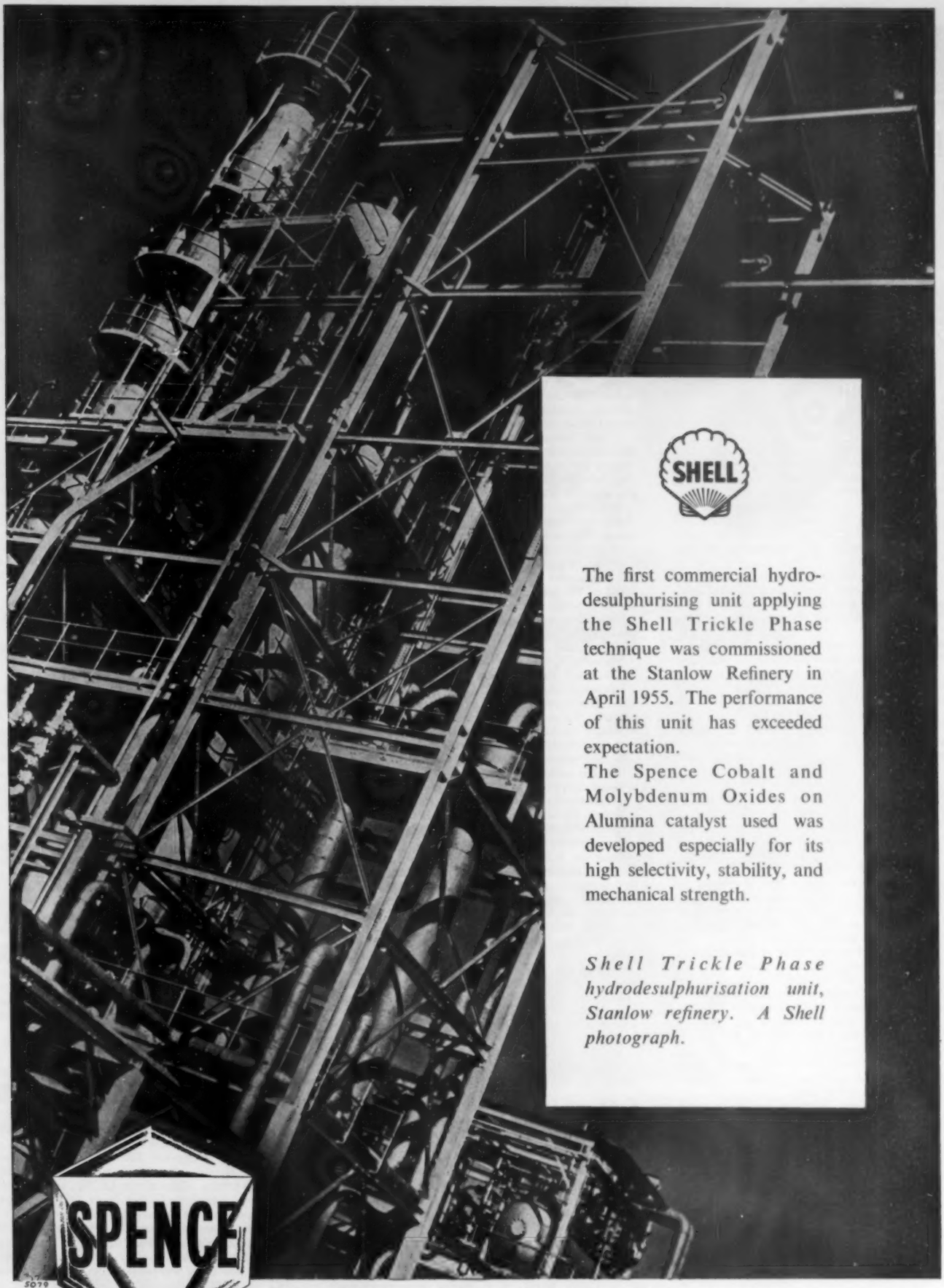

SHELL

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Shell Trickle Phase hydrodesulphurisation unit, Stanlow refinery. A Shell photograph.

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SALT DOME DISCOVERY ADDS INTEREST TO CUBAN WILDCATTING CAMPAIGN

By Ruth Sheldon Knowles

The discovery of the first salt dome, seven important wildcats drilling, seven more scheduled within 90 days and the entry of additional major companies has fanned the flames of interest in Cuba to a new high.

One of the most significant discoveries in Cuba's newly unfolding oil history is the penetration of a salt dome on the northern coast of Camaguey Province in a wildcat which was drilling below 8,000 feet in May. The well drilled in salt from 6,200 to 7,800 feet and then went into clay. Salt domes have long been suspected on the northern coast, but this first confirmation of such potential traps of prolific production is giving the north coast a "new look."

The wildcat is located on an Atlantic Refining Co. farmout to Dr. Antonio Iglesias, lawyer-wildcatter of Havana, and Kewanee Oil Co. of Philadelphia. The test is supported by Atlantic. Another highly encouraging aspect of the discovery is that at 3,510 feet the well encountered 50 feet of reservoir rock-limestone, 98% soluble in acid—capped by 100 feet of shale.

Kewanee and Dr. Iglesias plan to drill to the capacity of their National 75 rig, do additional seismograph work in the area and drill additional tests in search of the possible oil accumulations on the flanks of the dome.

The salt dome discovery shared the oil exploration spotlight with the announcement of Standard Oil Co. of New Jersey that it had consummated a deal with Cuban Canadian Oil Co., to acquire a 75% checkerboard interest in some 926,525 acres in Havana, Matanzas and Pinar del Rio Provinces. Esso Standard Oil Co., S.A., Jersey Standard subsidiary, gave Cuban-Canadian a 5% overriding royalty on any production Esso develops and Esso has the option of developing Cuban-Canadian's 25% of the acreage on a 50-50 basis.

Jersey's climb onto the Cuban bandwagon set off a general scramble as the representatives of Superior, Tidewater, Phillips, Sun Texas and Union Oil converged on Havana to comb over the concession picture. These newcomers have found the pickings rather slim as the majority of Cuba's 28 million acres and vast submerged shelves are blanketed by concession rights held by other majors and a large number of independent oil companies. (See WORLD PETROLEUM, October 1955 and March, 1956). So farmouts are the land pattern in Cuba today.

Jersey's re-entry into Cuba which it abandoned in 1947, followed Atlantic's similar re-entry last year to reacquire not only all its former holdings but a considerable portion of those Jersey once held.

An important newcomer to the scene on a large scale is White Eagle International which has acquired all of Perla Negra Oil Co.'s 3,000,000 acre holdings scattered throughout the island. It is understood that the company, which will be operated by White Eagle Oil Co. of Tulsa, Oklahoma, is preparing a public issue of its stock.

In the midst of all the jockeying for concessions and farmouts, actual exploration is progressing rapidly.

Kewanee Oil Co., which just bought the Thomas Bess lease of 2,090 acres from Ted Jones Enterprises just east of Havana in the Bacuranao oil field area, started a fourth well, drilled through the serpentine at 3,800 feet had a showing of high gravity oil at 4,100 feet and were drilling ahead at 4,500 feet the first of May. Kewanee started testing the Jones No. 3 well on this lease and at 2,200 feet had a gas blowout which cleaned out the hole and would build up 860 pounds pressure in a few minutes and had an estimated 850,000 cubic feet of sweet gas. Kewanee has brought another T32 rig to Cuba for this lease and plans a thorough drilling program to prove the potentialities of this new oil area.

Kewanee was drilling in Tertiary (lower middle Eocene) below 5,500 feet in its wildcat on a 50,000-acre farmout from Gulf south of the Jatibonico discovery field in central Cuba. Kewanee will drill 30,000 feet of hole on this farmout and plans to do seismograph work in the area.

Cuban American* has two wildcats drilling in central Cuba. One, 8½ miles east of Sancti Spiritus, being drilled on a seismograph high was drilling below 7,000 feet in igneous material, having been in igneous material since 3,500 feet. This is a contemplated 14,000-foot test.

Cuban American's wildcat directly southeast of the Jatibonico oil field, also being drilled on a seismic structure, was drilling in Upper Cretaceous clay below 4,000 feet and has had numerous oil and gas shows.

Trans-Cuba Oil Co., to date the only explorer in the Cauto basin in Oriente Province, eastern Cuba, has started another wildcat on a large surface structure on the edge of the town of Manzanillo, on the Gulf of Guacanayabo. Drilling below 2,400 feet, the test is planned for 10,000 feet. Miocene was encountered at 843 feet. Trans-Cuba has two seismograph crews at work in the area.

Benedum and Trees and Russell Cobb, Jr., plan to start their first test on their holdings in the Cauto basin no later than August.

Stanolind Oil & Gas Co. also may start a test on its farmout from Cuban Venezuelan Oil Voting Trust and Trans-Cuba Oil Co. in the Cauto Basin by July. The company has a land seismograph crew at work in the area. Its water crew has finished seismograph exploration in the Gulf of Guacanayabo and is currently working in the waters around the Zapata Peninsula in western Cuba. Stanolind has concluded aerial photography and airborne magnetometer surveying of all its 11,000,000-acre farmout.

Of particular interest is a test being drilled by Simpson Drilling Co. in northern Pinar del Rio Province which had a good show of oil at 1,300 feet and is drilling below 1,700 feet.

Pinar del Rio is the center of Atlantic's and now Jersey Standard's interest. In 1946, Jersey drilled a test in northern Pinar del Rio to a depth of 8,600 feet in Paleocene. This well had 8,000 feet of Tertiary section containing numerous porous zones. The most promising was a zone from 3,860 to 4,075 feet, which might have produced with modern fracture treatment. Atlantic now owns this concession.

Atlantic has just given a farmout in Pinar to the Mariel Petroleum Co., a Cuban group. Involving 1,875 acres and support by Atlantic, the company will drill two 4,000 to 7,000 wells.

With all the current and planned wildcat activity, Cuba is in the situation where any day the lid may blow off this boiling exploration pot, and each foot of hole drilled is a revelation adding new facts to hasten the solution of Cuba's geological problems.

Gulf and Independents Enter Bolivia

A new crude oil pipe line to the Pacific Ocean may be started in Bolivia—perhaps this year. A "letter-agreement" to this end has been signed by the Bolivian Government and Bolivian Gulf Oil Co.

The project is based upon steadily expanding crude oil reserves and production of crude oil in the years ahead. During 1955, Bolivian crude oil production was about 11,000 b/d, but a production of 17,000 b/d is expected in 1956.

Of their year's production, some 7,000 b/d would be used for domestic needs; some 4,000 b/d would go to fulfill terms of a barter agreement with Argentina; and 6,000 b/d would be available for export.

The planned line would go from Sicasica, Boliva, some 201 miles west to Arica, Chile. Some 156 miles would be 10¾ inches diameter, and 45 miles would be 8⅝ inches. A pumping station would be located at Sicasica. Plans were drawn up by Williams Brothers, which also constructed all the other pipe lines that the government owns.

The plans also call for a marine terminal at Arica, with facilities for receiving and distributing crude oil and products, and the erection of four 50,000 barrel tanks with floating roofs and a loading line to the tankers.

Under the letter of agreement, the government would pay $5.5 million of the cost; Bolivian Gulf would pay $5 million.

The letter also paves the way for Bolivian Gulf to acquire the right to explore 3,750,000 acres within the reserve of the Bolivian government oil agency (YPFB). Within four years, Bolivian Gulf may select 1,125,000 acres in which it will have exploitation rights for 40 years.

The company would pay the government 11% royalty in oil from production and 19% exploitation tax payable in cash. The letter also calls for the company to help finance the pipe line. Gulf is subject to 30% tax on gross profits, payable in oil or foreign exchange. Three U. S. companies hold 20% interest in the venture. They are Falcon Seaboard Drilling Co., Barry & Reiner, Inc., and Williams Brothers, pipeline constructors.

The letter of agreement is subject to approval of the legislative body of Bolivia, which is to be elected later this year, and to open sessions in August. The Sicasica-Arica line is but one part of the oil expansion envisioned in Bolivia. The line will have a capacity of 50,000 b/d ultimately. This is because the government is optimistic about all prospects.

In order to feed this much crude into the line, a second line, to cost $35 million, would have to be constructed from the Camiri oil fields to Sicasica. The letter agreement gives Bolivian Gulf an option to finance this pipe line, as well.

The economic justifications of the pipe line foresee sales of the crude oil at Arica for $3.50 a barrel, although some Bolivian sources think the oil worth $3.85, as comparable to Bradford, Penna., crude oil.

The costs of production are estimated at 80 cents a barrel at the wellhead; plus .1387 cents for pipe line transport from Camiri to Cochabamba plus .4637 cents for pipe line transport to Arica. This adds up to $1.4024 per barrel landed at Arica. Another 10 cents or so is estimated as the cost in Bolivianes, the local unit of currency.

This calculation foresees a net value per barrel placed in tankers of $2.0976 per barrel, less the cost in Bolivianes. On the basis of 6,000 b/d through the pipe line, Bolivian authorities foresee some 1,500 b/d, or a net value of crude of $1,132,280 a year, that could be applied against the cost of the line.

The crude oil reserves of Camiri alone justify the pipe line, according to Bolivian sources. The government estimate reserves in this field at 47,670,000 barrels and at Guayrui at 5,000,000 barrels.

In addition, the government says: "One should also take into account the development of new fields situated between the wells of Camiri and Guayruy, which form the same chain and are designated as North Itapirenda and South Itapirenda, They both possess very great petroleum possibilities and will be tested in 1956 with the drilling of exploratory wells, the rigs being already on location."

"Finally, various other fields are also within the orbit of the Camiri-Cochabamba-Arica pipe line. They include Buena Vista, Camatindi and Los Monos (the McCarthy concession), which have wells now in production. Other fields and structures already geologically located extend the length of a broad fold from Camiri to the Argentine frontier."

The oil pipe line network in Bolivia (mostly six inches) now extends from Yacuiba north 160 miles to Camiri; northwest 310 miles to Cochabamba, with a 47 mile, 4-inch Lamboye-Sucre offsheet. West to Oruro, Sicasica and La Paz, some 234 miles. Planned lines include one from Bermejo north to Yacuiba, and the Sicasica to Arica line.

In the future, lines may be laid from Santa Cruz south to Camiri and from Camiri to Sucre, Orure and Sicasica. Historically, crude oil output in Bolivia has been increasing from 525,769 barrels in 1952 to 2,692,552 barrels in 1955. Completed wells came to 13 in 1952; 14 in 1953; 17 in 1954; and 21 in 1955. Four rotary rigs and two cables were operating in 1952, and seven in 1955. Crude oil exports came to 63,585 barrels in 1952 and 1,584,133 in 1955.

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International News and Notes

Colombo, Ceylon

Imports of products came to 229,942,000 imperial gallons (17,999 b/d) during 1955, according to official reports. The value is estimated at 131,684,000 rupees ($27,863,640).

Ships bunkers and airplanes took 115,251,000 imperial gallons, and re-exports 3,094,000. Imports were as follows:

Imports	*Imperial Gallons*
Kerosene	25,418,000
Gasoline	38,267,000
Aviation gasoline	2,103,000
Lube oil	2,088,000
Gas oil	9,405,000
Diesel oil	41,320,000
Furnace oil	108,938,000
TOTAL	229,942,000

Esso Grants French Butyl License

Esso Research and Engineering Co. has announced that it has issued a license to Societe du Caoutchouc Butyl (SOCABU), for the first Butyl synthetic rubber plant to be built overseas.

The plant is to be built at Port Jerome, in the region of Le Havre, France. Engineering work has already been started. Construction is expected to be completed in 1958. It will have a capacity of 20,000 tons per year. The unit will be the fourth Butyl rubber plant in the world.

Iraq Oil Profits

Under the equal profit sharing agreement, the Iraq Petroleum Co., Ltd. and its associates have paid £18,692,851 ($52,339,980) to the Iraq Government as its share of the profits arising out of their oil operations during the first three months of 1956. This is 6.1% lower than the £17,618,033 paid in the corresponding period in 1955.

Gulf Explores Gold Coast

Petroleum exploration and development concession rights over a tract of about 100 square miles of the southwestern corner of the Gold Coast were granted on Feb. 3 by the Omanhene and the chiefs concerned to the Gold Coast Gulf Oil Co. A lease over an area of equal size was granted the same day on offshore waters over a strip three miles in width and slightly over 30 miles in length.

The agreements reached are on the basis of 50% of the net profits to be paid to the Gold Coast, including 12% royalties to be paid to local chiefs.

Drilling is scheduled to begin in 1956. The location of the first 10,000 foot test has not yet been selected.

Concession boundary surveys have already been started and the estimated cost of the first well to 10,000 feet is about $840,000.

Kuwait Crude Export Up

Crude oil exports from Kuwait proper came to 66,056,598 barrels (1,100,943 b/d) during the first two months of this year plus 207,339 barrels (3,456 b/d) of distillate fuel oil. This is 3.3% higher and 25.4% lower than 1955 (based on the first 11 months), respectively.

Exports from the Neutral Zone by American Oil Co. came to 1,024,776 barrels (17,080 b/d); and by Pacific Western Oil Co. to 816,989 barrels (13,616 b/d).

Details are as follows:

February 1956 Exports—Barrels

Kuwait	*February*	*January and February*
Crude Oil	31,707,285	66,056,598
Distillate	—	207,339
Neutral Zone		
Crude Oil (AIOC)	542,533	1,024,776
Crude Oil—Pacific Western	537,110	816,989

Major Destination of Kuwait Crude

	February	*January and February*
United Kingdom	3,025,561	22,400,465
United States	1,038,825	7,688,749
France	1,036,366	7,669,867
Italy	816,482	6,043,889
Holland	711,920	5,270,121

South-East Asia

BRUNEI, British Borneo: Production from The British Malayan Petroleum Co.'s field at Seria, Brunei, was approximately 3,540,150 barrels in March, an average of 114,198 b/d. This was slightly up in February, final figure for which is 3,292,355 barrels, an average of 113,529 b/d. (29 days). Exploration drilling continues in Brunei at Jerudong, midway between the existing Seria field and the State Capital, Brunei Town; and from two marine platforms located one mile and 1,000 yards respectively from the coastline at Seria.

MIRI, SARAWAK, British Borneo: Production from Sarawak Oilfields Ltd.'s declining field at Miri was 43,758 barrels approximately during March, an average of 1,411 b/d. Finalized figures for February were 40,695 overall, an average of 1,403 b/d. In Sarawak, main outstation activity is centered at Semilijau, a jungle deep-test about 70 miles south along the coast from Miri field.

Petrofina and Panhandle

Panhandle Oil Corp. will assist Cie. Financiere Belges des Petroleo (Petrofina) to enter the U. S. market. It was stated at the Petrofina meeting in Brussels on March 20, that Canadian Petrofina had bought 600,000 Panhandle shares at a cost of $7 million. American Petrofina was to be formed in April with a capital of $20 million, divided equally between Petrofina and Canadian Petrofina. There is a possibility of a public issue in the U. S. at a later date.

Indian Government Reserves Oil Rights

In an official statement of Feb. 10, 1956, the Indian government expressed the opinion that mineral resources "are of vital importance for the country's industrial development and it is essential that their exploitation should be governed by public purpose and contribute the maximum to the furtherance of national development. This can best be secured by the State itself undertaking the further development and exploitation of these resources. There may be special cases where the importance of the mineral concerned may not warrant public ownership and management."

Shown above is Tumauini No. 1, a wildcat well being drilled by Kern Drilling Co. International for Phodco, a Philippine company. At last report the well is over 6,000 feet with no shows reported. Location is about 250 miles from Manila, in the Cagayan Valley, where Phodco has extensive holdings (see map in World Petroleum, April 1956). Caltex has a working interest in the well.

Drilling to Start in India by June

Immediate action is to be taken on the preliminary Russian recommendation for drilling in the Jwalamukhi area where a geological survey has been completed. Seismic and gravity surveys are not possible in view of the hilly nature of the country. The Ministry of Natural Resources has decided to start drilling operations by June, 1956. A rig recently obtained from Romania will be used.

Big-Moving Helicopters in Borneo

Fresh from moving a specially-lightened Brewster rig in New Guinea, two British-built Westland Whirlwind helicopters have arrived at Seria oilfield, Brunei, British Borneo, and went into service on April 1st. They are being operated on charter by an American concern, Bahamas Helicopters Ltd., which for the past 18 months has been flying two small Bell 47D's in Seria.

The Whirlwinds are to be used in Borneo for transport to exploration outstations, and in connection with drilling operations in the South China Sea. Seria has three marine platforms, each about a mile offshore. All have now been fitted with helicopter platforms, and the Whirlwinds will be used for shift-changes. In tropical conditions they can carry 1,500 pounds of freight or seven passengers.

While in New Guinea, the Whirlwinds were used by a Shell Group company to ferry the rig into and out from a jungle drilling location on an island eight miles off the mainland.

The rig, stripped down, was landed by ship on the island's beach, placed in 1,500-pound lots in cargo nets, and lifted by the helicopters from a hovering position. Undertaking about 20 trips each per day, the Whirlwinds flew the complete rig about four miles inland in a couple of weeks. During drilling they kept it supplied with casing, drill pipe, mud chemicals and all domestic requirements.

After drilling was complete, the helicopters flew the rig back to the beach head in about a month's ferrying. The only land access to the location was a narrow jungle track along which labor gangs could march but no vehicle could pass.

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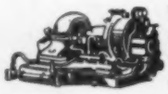

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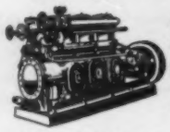

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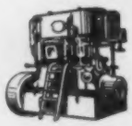

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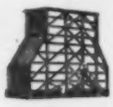

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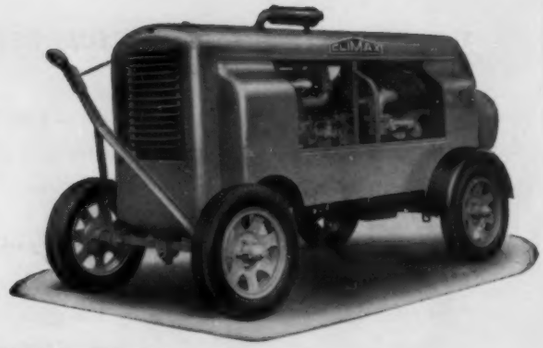

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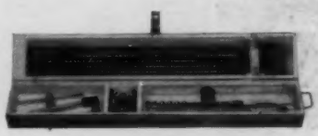

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Oil Company Staff Changes

ADEN P. WILLIAMS, JR. has been appointed marketing advisor of International Petroleum Co., Ltd., in the Coral Gables office. Mr. Williams began his career in 1933 with Esso Standard Oil Co. in Richmond, Virginia. In March of 1954, he accepted a position with Esso Standard Oil, S. A. Havana, Cuba, as manager of consumer and industrial sales, which position he held until his transfer to International.

DR. JOHN C. ZIMMER has been appointed assistant manager of laboratories of Socony Mobil Oil Co., Inc.

THOMAS A. HENDRICKS has been named superintendent of foreign exploration for the Stanolind Oil and Gas Co., Tulsa, to direct the firm's foreign exploratory activities other than Canada. He formerly was division geologist at Fort Worth, Texas.

John G. Voight has been named division geologist for the north Texas-New Mexico division, succeeding Mr. Hendricks. Mr. Voight moves to Fort Worth from Tyler, Texas, where he was district exploration superintendent. He joined Stanolind in 1948, as consulting geologist, after 19 years' service with the U. S. Geological Survey. Two years later, he moved to Midland, Texas as district exploration superintendent for the Midland district and, in 1951, he became division geologist in Fort Worth.

C. J. HEDLUND, J. M. B. Howard, R. R. McCoy, and T. E. Monaghan, all executives of Jersey Standard, have been elected directors of Esso Export Corp., world-wide wholesale marketing affiliate of Standard Oil Co. (N.J.). They will continue in their present positions while serving as members of Esso Export's board of directors.

Shepard Dudley has been appointed Esso Export's new vice president and will continue to manage Esso Export's international aviation sales department.

JOHN NOBLE has been elected president of the Trans-Arabian Pipe Line Co. (Tapline). Mr. Noble resigned as associate general counsel of the Arabian American Oil Co. to accept his new post. Mr. Noble will make his headquarters in Beirut, Lebanon.

C. A. Swigart, who has been president of Tapline since 1951, was elected chairman and chief executive officer. W. R. Chandler, vice president of Tapline was elected executive vice president.

WALTER A. ARNOLD, formerly assistant refining coordinator in the New York headquarters of Standard-Vacuum Oil Co., has been appointed managing director of Standard-Vacuum Refining Co. of South Africa, Pty., Ltd., at Durban. J. B. Hanna, whom he succeeds, has returned to the United States for reassignment.

M. BOGSTAHL, operations manager of the St. Louis division, has been named manager of the marketing engineering department of Shell Oil Co., head office, New York. He succeeds C. J. Nobmann, who retired March 31 after 33 years' service. J. S. Hoppock, Detroit sales manager, will become operations manager, St. Louis. E. F. McGee, operations manager, Albany division, will become sales manager, Detroit. H. Wearne, acting manager of the marketing engineering department in New York, will become operations manager, Albany.

JOHN H. G. BOER, of Paterson, N.J., has been named safety supervisor of Tidewater Associated Oil Company's eastern division.

CHARLES L. PISKAC, a former territorial manager of Oil Base, Inc., Compton, Calif., has been promoted to assistant division manager in the Oklahoma, Kansas, Louisiana area with headquarters at Houston. He will report to A. K. Brown, division manager. Chas. DeAinza has been appointed territorial manager of the San Joaquin area of California.

HERBERT EUGENE REA, a former sales manager for Standard Vacuum Oil Co., has been named director of United States Operations Mission to Cambodia, it is announced by the International Cooperation Administration.

ARTHUR B. ALLYNE, of Houston, has been elected a vice president of the Pacific Northwest Pipeline Corp. Mr. Allyne has been project engineer for Fish Northwest Constructors, Inc., since February, 1955, the company which has had the task of engineering and constructing the Pacific Northwest system.

The Pacific Northwest pipeline will transport natural gas 1,487 miles, from New Mexico to the Canadian Border north of Bellingham, Washington, and will serve the states of Idaho, Oregon and Washington, the last major U. S. area which does not now have natural gas.

George F. Getty II

GEORGE F. GETTY II has been appointed vice president and general manager of the eastern division of Tidewater Oil Company. Until recently he was executive vice president and director of Pacific Western Oil Corp., Los Angeles. He was elected a director at the annual meeting of stockholders on May 3. Mr. Getty will also serve as chairman of the operating committee, eastern division and will make his headquarters in New York City. He will be in charge of all operations of that division of the company which markets petroleum products in New England and the Middle Atlantic States.

B. W. S. DODGE has been appointed director of advertising for the Gulf Oil Corp. In his new position he assumes direction of all of Gulf's newspaper, billboard, radio, television, and other advertising efforts, succeeding W. E. Dermody, who retired recently.

WILL W. WHITE, a veteran of more than 25 years in the aviation fuel and lubricants field, has been elected a vice president of Esso Research and Engineering Co. Mr. White will serve in a consulting and advisory capacity, analyzing developments affecting petroleum products used in aircraft.

JOHN H. WENTS, JR. has been named assistant general manager of Tidewater Associated Oil Co.'s central division, with headquarters in Tulsa, Oklahoma. He succeeds Charles R. Brown recently advanced to general manager of the central division.

JESSE D. WINZENRIED of Dobbs Ferry, New York has been appointed administrative coordinator for Husky Oil Co., effective April 1. He formerly was director of field service research for Tax Foundation, Inc., in New York.

W. W. Lowe

W. W. LOWE, vice president and director of Cities Service Petroleum, Inc., has been elected president of the Wolverine Pipe Line Co. He succeeds C. S. Gentry, who is retiring.

Mr. Lowe is also a director of Cities Service Refining Corp. and of Cities Service Research and Development Co. He has been associated with Cities Service for more than 40 years.

Guy T. Notley

GUY T. NOTLEY has been succeeded as operations superintendent of The British Malayan Petroleum Co.'s field at Seria, British Borneo, by James Kenneth Newman, an Australian from Brisbane.

Mr. Notley is returning to Britain for vacation and later to take up a new appointment at the London office of Shell Group.

A. O. Savage

A. O. SAVAGE, an assistant comptroller of Standard Oil Co. (N.J.), has been appointed deputy comptroller. Jersey Standard also announced the appointment of three assistant comptrollers. They are: W. J. Edmonds, formerly assistant to the comptroller; and W. C. Jennings and H. W. Kull, both formerly administrative assistants in the comptroller's department.

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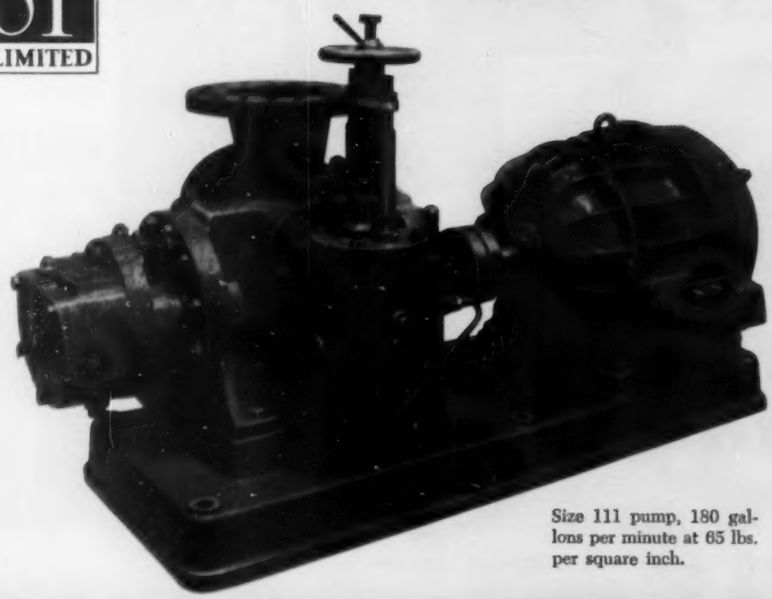

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The unit shown in the photograph, recently completed for a South American refiner, is but one of the 17 alkylation units designed and constructed by Foster Wheeler. This cumulative experience is available to refiners everywhere — for evaluating the economics of the process and undertaking full responsibility for plant design and construction. For complete information, write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

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Gulf Declares 62½¢ Dividend

Gulf Oil has declared a dividend of sixty-two and one-half cents (62½¢) per share, payable June 8, 1956 to shareholders of record May 4, 1956.

Vaughan Receives Natural Gasoline Award

W. H. Vaughan, manager of the gas utilization department, Tide Water Associated Oil Co., has received the Hanlon award, called the highest honor in natural gasoline.

The award was presented for "studies of high pressure, two-phase gas streams . . . work, experimentation and original thinking in this field which mark him as one of the earliest pioneers in finding a practical solution to the gas cycling problem."

Frank Guernsey Keefe

Frank Guernsey Keefe, chairman of the board of directors of Caltex Trading and Transport Co., Ltd., a Caltex group affiliate in London, died in Portland, Oregon recently. Mr. Keefe, who had 35 years of service in the international petroleum industry, joined The Texas Co. in 1921. In July, 1954 he was appointed Caltex resident director, the position he held at his death.

Appointed General Manager

Claude W. Bard has been appointed general manager of Garvey Drilling Co., Wichita, Kans. He formerly was general superintendent. Mr. Bard has been in the drilling industry for the past 25 years. He joined Garvey in 1948 after 13 years with Earl F. Wakefield.

Eight foreign guests were honored by the N. Y. Chapter of Nomads at its March meeting. Seated; left to right: A. L. Almonia, G. E. Failing Co., I. Wood, Esso Standard Oil; L. D. Josephson, California-Texas Oil, Philippine Is.; G. B. Birkett, British Petroleum Co. Second row, left to right: J. E. Anerson, British Petroleum Co.; T. Tucker, G. E. Failing Co.; G. A. Koscioluk, Socoil, Argentina; P. Docksey, British Petroleum Co.

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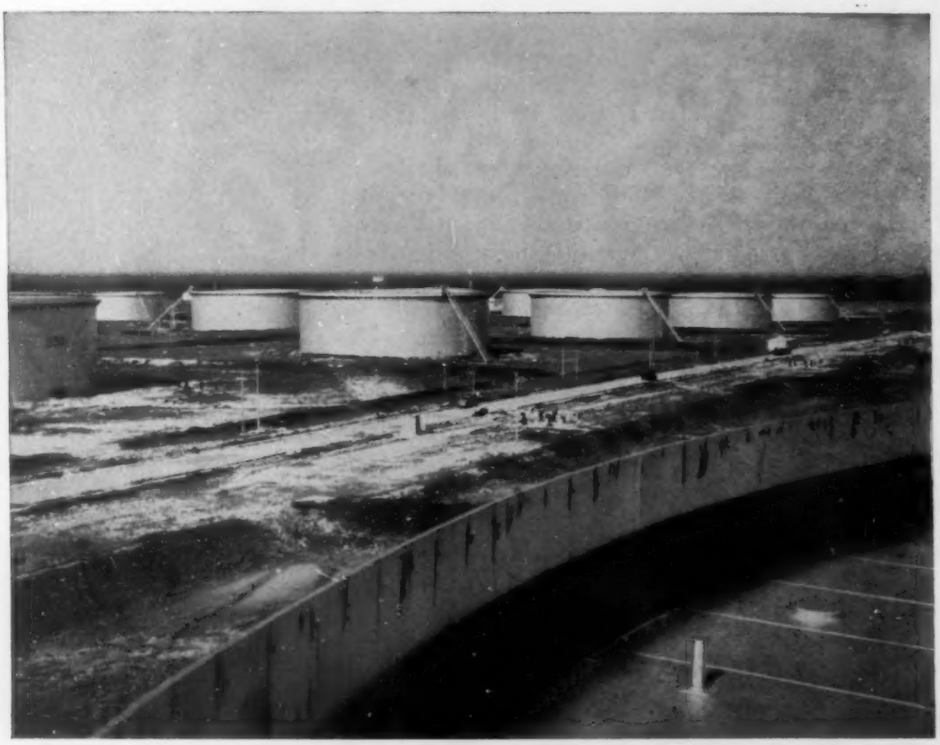

The Iraq Petroleum Company's Tank Farm at Banias, Syria

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Forecasts 100 Octane By 1960

100-octane gasoline for automobiles will be common throughout the United States by 1960, as forecasted by John G. Moxey, Jr. of Sun Oil Co., at a meeting of the Natural Gasoline Assoc. of America at Forth Worth, Texas. He said premium-priced gasoline will average 100 octane by then and regular grades will average 93 octane. Average automobile engine horsepower will rise to about 245 from the present 205 and average compression ratios to 10:1 from the present 8:4 by 1960. Savings of nearly 10% are anticipated in fuel economy. Some fuel injection devices may be used but their general acceptance is not at all assured yet.

Universal Plans Construction

Universal Oil Products Co. will construct two new buildings and an addition to its administrative headquarters in Des Plaines, Illinois, at a cost of approximately $750,000. An automotive laboratory, will house equipment used in research. The other new building will provide space for maintenance shops and supplies.

New Octane Improvement Process

A new octane-improving process has been announced by Universal Oil Products Co. It is known as Penex, and enables the refiner and natural gasoline manufacturer to upgrade economically pentane and hexane fractions.

A company spokesman predicted that Penex will be widely applied to the problems of upgrading natural gasoline, as well as the low boiling fractions of straight-run and cracked refinery products.

Horton Elected Chairman

Horace B. Horton has been elected chairman of Chicago Bridge & Iron Co., Chicago, Illinois. Mr. Horton joined the company in 1907 and had been president since 1945.

Ernest E. Michaels, formerly executive vice president, succeeds Mr. Horton as president. Charles S. Pillsbury, formerly vice president and treasurer, was elected vice president and secretary. Arthur B. Horton, formerly assistant treasurer, was elected vice president and treasurer.

George E. Borst, district sales manager of the New York sales office of Chicago Bridge & Iron Co., was elected vice president.

Gulf Advances $120 Million To Union Oil

The Union Oil Co. of California will sell $120,000,000 of convertible debentures to Gulf Oil Corp. to finance increased capital expenditures. As part of the transaction, Union will get access to Gulf's crude oil production at the market price from Kuwait, Canada, or Venezuela.

Gulf Oil said there definitely was no plan of merger at this time. Gulf has an excess supply of crude in Kuwait, which now is producing about 1,100,000 barrels of crude oil a day.

Shell Predicts Sharp Consumption Rise

According to J. W. Platt, a managing director of the Royal Dutch Shell Group, world energy demand has risen 2½ times since 1920, during which period oil and gas consumption increased about seven fold to over half of all energy supply, compared with 7% for hydro-electric power and less than half for coal. Nuclear energy will rise to about 7% in 1975.

The 1975 world oil demand will be well over 1,600 million tons (32 million b/d), rising to a minimum of 40 million b/d in year 2000.

World proved reserves are at present about 170,000 million barrels. Probable reserves (including the continental shelf) are about 1,000,000 million barrels.

Changing oil requirements will make the U.S. an importer of about 3 million b/d in 1965, almost as much as the Middle East produces at present, of which about half would come from the Western Hemisphere, the balance from the Middle East.

Oil Industry Film

The complete story of an integrated oil company's operations—exploration and producing, refining, transportation, marketing and research—is portrayed in a 30-minute, 16-mm color film, "The Story of a Star," released by The Texas Company.

The movie, two years in the making, covers the entire scope of petroleum operations undertaken by a major integrated oil company, and provides a broad documentary view of a basic American industry.

Houdry Net Up In 1955

Consolidated net income of Houdry Process Corp. and subsidiaries, after taxes, amounted to $900,083, for 1955 as against $393,508 in 1954.

Earnings per share for 1955 were $2.75, as against $1.20 the previous year.

The corporation's consolidated net income includes $517,294 net income of Catalytic Construction Co., Houdry subsidiary, and a Houdry operating net of $382,789 which reflects income as the result of favorable settlements of litigation.

Highest Earnings In Company's History

Seismograph Service Corp. reports that for the year ending Dec. 31, 1955, the gross income, including its non-consolidated subsidiaries Seismograph Service Ltd., and Compagnie Francaise de Prospection Sismique totalled $11,618,875, which is the highest since the founding of the company 25 years ago. The gross income of the company, excluding these subsidiaries, was $8,520,814 for the year.

Despite heavy domestic losses early in the year, the net profit, considerably helped by dividends and research and management fees from Seismograph Service, Ltd., amounted to $743,308, or $2.12 per share, compared to $618,986, or $1.77 per share, in 1954.

This information was included in the firm's annual report being mailed to stockholders this week.

Seismograph Service Corp. paid four dividends totalling $1.00 per share in 1955.

In addition the company contributed $82,308 to its Employees' Profit Sharing (Pension) Trust.

New Buildings By Esso

Three new buildings, one of them a five-story office structure, are to be built by the Esso Research and Engineering Co. at its Esso Research Center site in Linden, N. J.

New Unit Protects Valves & Gages

Jerguson Gage and Valve Co., Somerville, Massachusetts, has announced the development of an electrically heated unit for valves and gages. In cold weather the unit prevents gage freezing and breakage, and is valuable where there is need for very close control of temperatures in the gage glass.

New Babcock & Wilcox Director

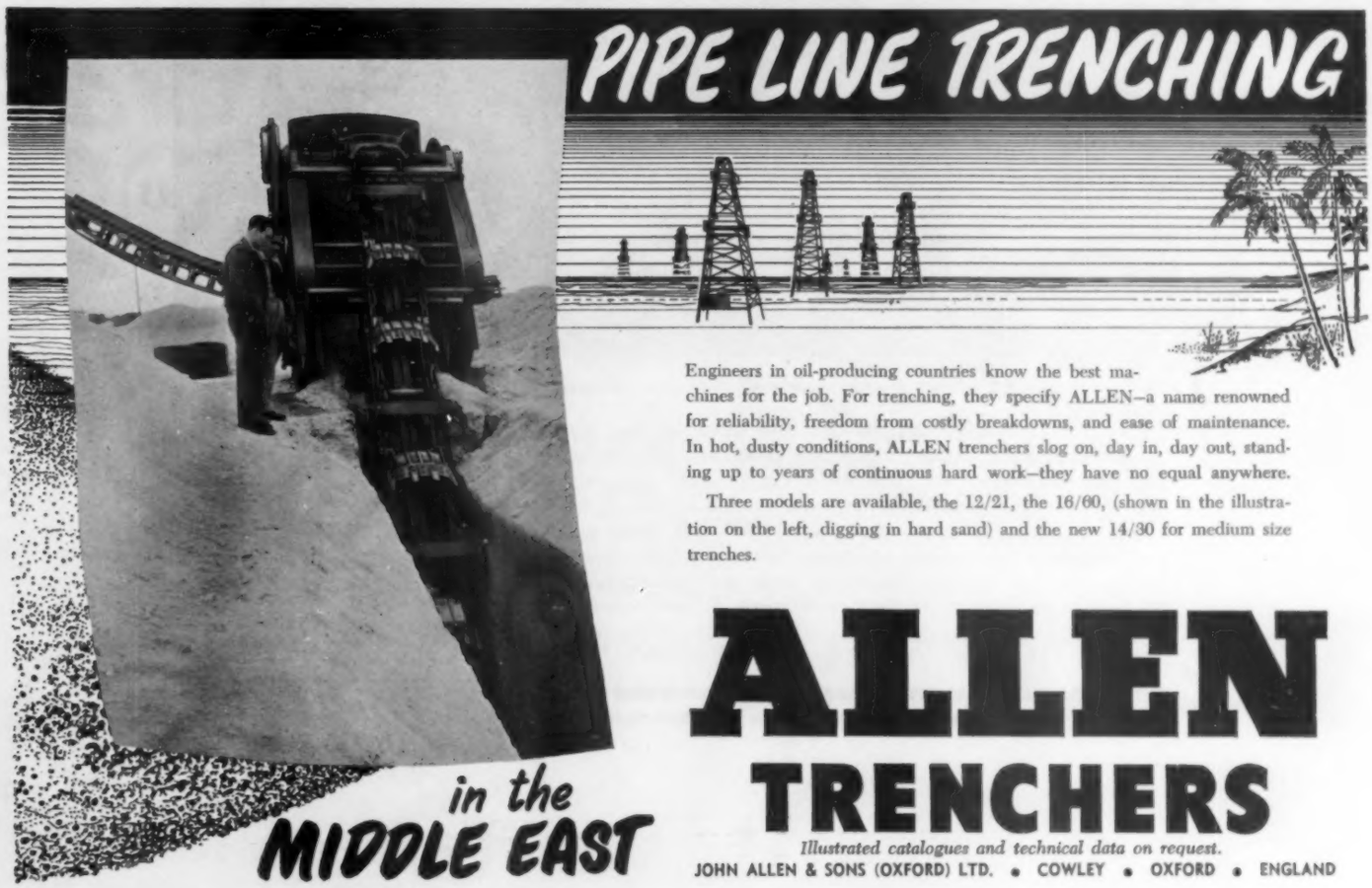
L. S. Wilcoxson, vice president of The Babcock & Wilcox Co. has been elected a director and will continue to be in charge of the boiler division.

Nomads and guests gathered in Houston to hear J. B. O'Connor, executive vice president of the Dresser Industries, relate his experiences in Russia and the turbo drill. Shown from left to right are: G. H. Ratcliffe, drilling engineer, Shell Company of Venezuela; W. B. Thomas, division manager, A-Z Export Co., S.A., Maracaibo, Venezuela; C. Hayden Dye, sales engineer, A-Z Export Co., S.A., Anaco, Venezuela; Willard Johnson, president, Magnet Cove Barium Corp., Houston; Thomas E. McDowell, president, Petroleum Overseas Consultants, Houston; J. B. O'Connor, executive vice president, Dresser Industries, Dallas; Preston Dillion, vice president, Overseas Consultants, Houston.

Standard Of Indiana Consolidates

Jay H. Forrester, of Chicago, will be president of a new chemical company to be formed by the consolidation of three chemical subsidiaries of Standard Oil Co. (Ind.) at the end of this year. Mr. Forrester is now manager of research for Standard Oil. He will be succeeded in this position by Dr. Philip C. White, of Texas City, Texas, manager of research and development for American Oil Co.

The new chemical company will be headquartered in Chicago. Its name has not yet been selected. The chemical consolidation is part of a functional reorganization of nine Standard Oil subsidiaries into four.



Engineers in oil-producing countries know the best machines for the job. For trenching, they specify ALLEN—a name renowned for reliability, freedom from costly breakdowns, and ease of maintenance. In hot, dusty conditions, ALLEN trenchers slog on, day in, day out, standing up to years of continuous hard work—they have no equal anywhere.

Three models are available, the 12/21, the 16/60, (shown in the illustration on the left, digging in hard sand) and the new 14/30 for medium size trenches.

ALLEN TRENCHERS

Illustrated catalogues and technical data on request.

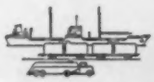
JOHN ALLEN & SONS (OXFORD) LTD. • COWLEY • OXFORD • ENGLAND

How Standard invested its money last year to meet your growing oil needs

New Refinery Units to make higher octane gasoline took a big part of the $30 million we spent for plant improvement.

Petrochemicals for plastics and other new products; fertilizers and sprays for bigger crops, took a $20 million investment.

Research and technical services cost nearly $13 million. One result was a technique which promises to greatly increase yields from oil wells, helping conserve U.S. resources.



Transportation Facilities to bring our products from oil field to you were a $10 million item.

New and Modernized Service Stations from Alaska to Mexico cost $16 million, made Standard products more convenient for you.

Exploration for new oil sources cost $134 million. Standard Oil Company of California produced oil and gas from more than 8600 wells in the U.S., Canada and South America to supply your petroleum needs.

production-exploration *refineries* *asphalt refineries* *Standard marketing area*

STANDARD IMPROVED its ability to serve you last year by investing $347 million for new production and distribution facilities and exploration. The rest of our $1⅓ billion income was spent on such items as wages and benefits for our 36,369 employees, supplies from more than 10,000 U.S. firms and crude oil from independent producers. We paid a $107 million tax bill, and our 119,793 stockholders received 7¢ of each dollar we took in as a return on their investment in the Company.

If you wish a copy of our Annual Report for 1955, write to Standard Oil Company of California, Rm. 2153, 225 Bush St., San Francisco 20, Calif.

STANDARD OIL COMPANY OF CALIFORNIA

puts petroleum progress to work for you

Petroleum progress means...
to keep pace with your needs, oil companies must invest $74 billion in new U.S. facilities by 1965

Demand for petroleum products will increase about 50% over the next ten years

Part of Standard's earnings came from our work in supplying oil for other free nations

PARIS TAXIS, African river boats and Australian airliners run on gasoline produced by Standard's affiliates. Last year in addition to our Western operations, we* produced oil in 5 Eastern Hemisphere countries, processed it at 15 overseas refineries, supplied petroleum products to 67 countries outside the Iron Curtain. The result was a big boost for industry of Free World nations, conservation of U.S. oil reserves, and a higher standard of living for the peoples of many lands.

If you wish a copy of our Annual Report for 1955, write to Standard Oil Company of California, Rm. 2153, 225 Bush St., San Francisco 20, Calif.

STANDARD OIL COMPANY OF CALIFORNIA
puts petroleum progress to work for you

All phases of operations expanded by

The British Petroleum Company Limited *in* 1955

British Petroleum occupies an important role in meeting the free world's expanding demand for petroleum, which last year continued the post-war trend which has resulted in a doubling of world consumption of oil products in the last ten years. This strong demand lies in the growth of industrial activity and improving standards of living and, in the Eastern Hemisphere, in the more limited capacity for increasing output of other major sources of energy, especially coal. There is every indication that this post-war rate of expansion will be maintained until nuclear power becomes available to supplement world energy resources on a substantial scale. Thus in the next ten years the world petroleum industry may well be again called upon to double its present output. The rate of expansion can be expected, as now, to be greater in the Eastern Hemisphere, where BP has the bulk of its operations. Also, the oil-producing territories of the Middle East, in which BP has a substantial position, are expected to contribute an increasingly large proportion of the world's requirements.

FINANCIAL HIGHLIGHTS

	1955	1954
Gross Consolidated Profit	£139,817,943	£118,228,792
Depreciation	£ 22,143,401	£ 30,406,091
Overseas and U.K. Taxes	£ 71,389,475*	£ 69,392,188
Net Profit to BP	£ 46,189,539	£ 17,043,404
Dividends	£ 15,719,085†	£ 9,254,999

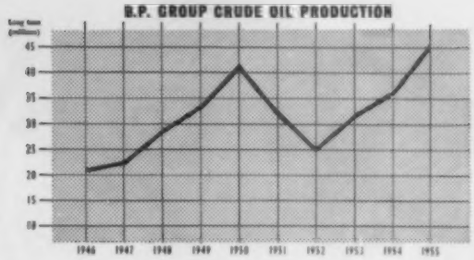
* Unilateral relief for overseas tax for 1955 only

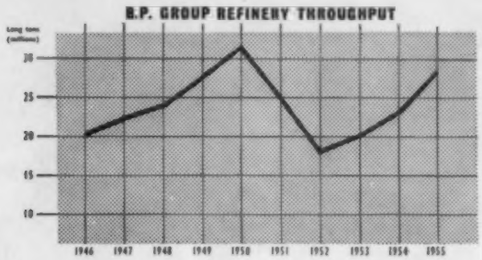
† Including recommended final dividend

THE BRITISH PETROLEUM COMPANY

BRITANNIC HOUSE • FINSBURY CIRCUS • LONDON • E. C. 2

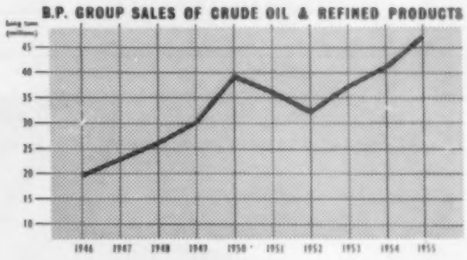
Crude oil production by BP last year rose 25 per cent to a new high of 920,000 barrels daily, with the increase due mainly to greater production in Iran and Kuwait. Total daily offtake from Kuwait, Iraq, Iran and Qatar was 910,000 barrels, compared with 730,000 barrels in 1954. The company's liftings last year from Iran, in which BP has a 40 per cent interest, was at the rate of 110,000 barrels daily.

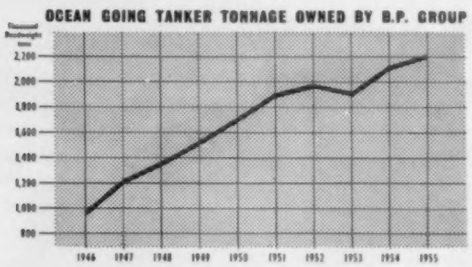




Refinery throughput at BP's 14 refineries during 1955 was 590,000 barrels daily, up 110,000 barrels over 1954. The increase was largely due to 1955 being the first complete operating year of Aden refinery, and the first operating year of Kwinana refinery in Western Australia. Also, BP's share of processing at Abadan refinery in Iran totaled 52,000 barrels daily during its first complete year of operation under the Consortium agreement of October, 1954.

Sales of crude oil and refined products in 1955 reached a record high of 960,000 barrels per day, an increase of more than 120,000 barrels over 1954. Approximately $55,000,000 was spent last year to strengthen and expand the company's world-wide marketing outlets. Noteworthy gains were made in Europe in 1955, where BP marketing associates increased their sales by more than 20 per cent.



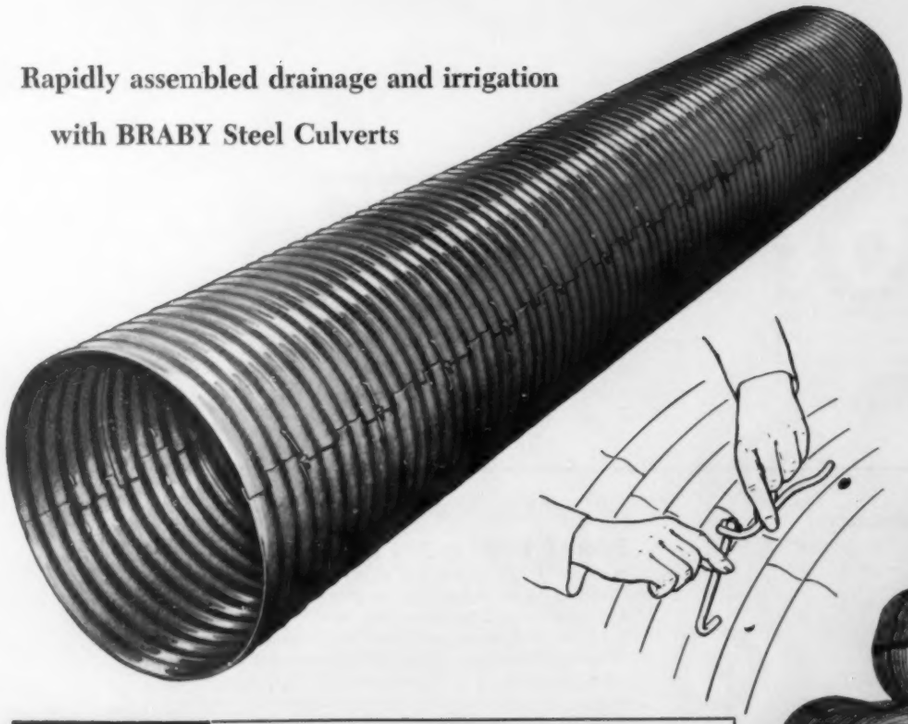


Forty-one tankers totaling 1,225,500 deadweight tons are on order for BP, the biggest ship building program in the company's history. The cost of this program, which includes ships ranging from 42,000 tons to 14,000 tons, will exceed $224,000,000. The company's present tanker fleet consists of 144 ships totaling 2,018,000 deadweight tons. In addition, some 2,500,000 deadweight tons of tanker shipping is on charter.

LIMITED

Copies of the Annual Report and Accounts may be obtained from the Company's Purchasing Agent in U. S. A., Mr. J. E. Anderson, 610 Fifth Avenue, New York 20, N. Y.

Rapidly assembled drainage and irrigation with BRABY Steel Culverts



These galvanized corrugated steel culverts are manufactured in standard diameters from 12in. upwards and in thicknesses from 18 g. to 10 g. The Units designed for economical shipment, are easily and securely fitted together on the site. A leaflet with details and instructions will be forwarded on request.

ONE OF THE WIDE RANGE OF BRABY PRODUCTS

FREDERICK BRABY & CO. LTD.

EXPORT OFFICE: 110 CANNON STREET, LONDON, E.C.4.

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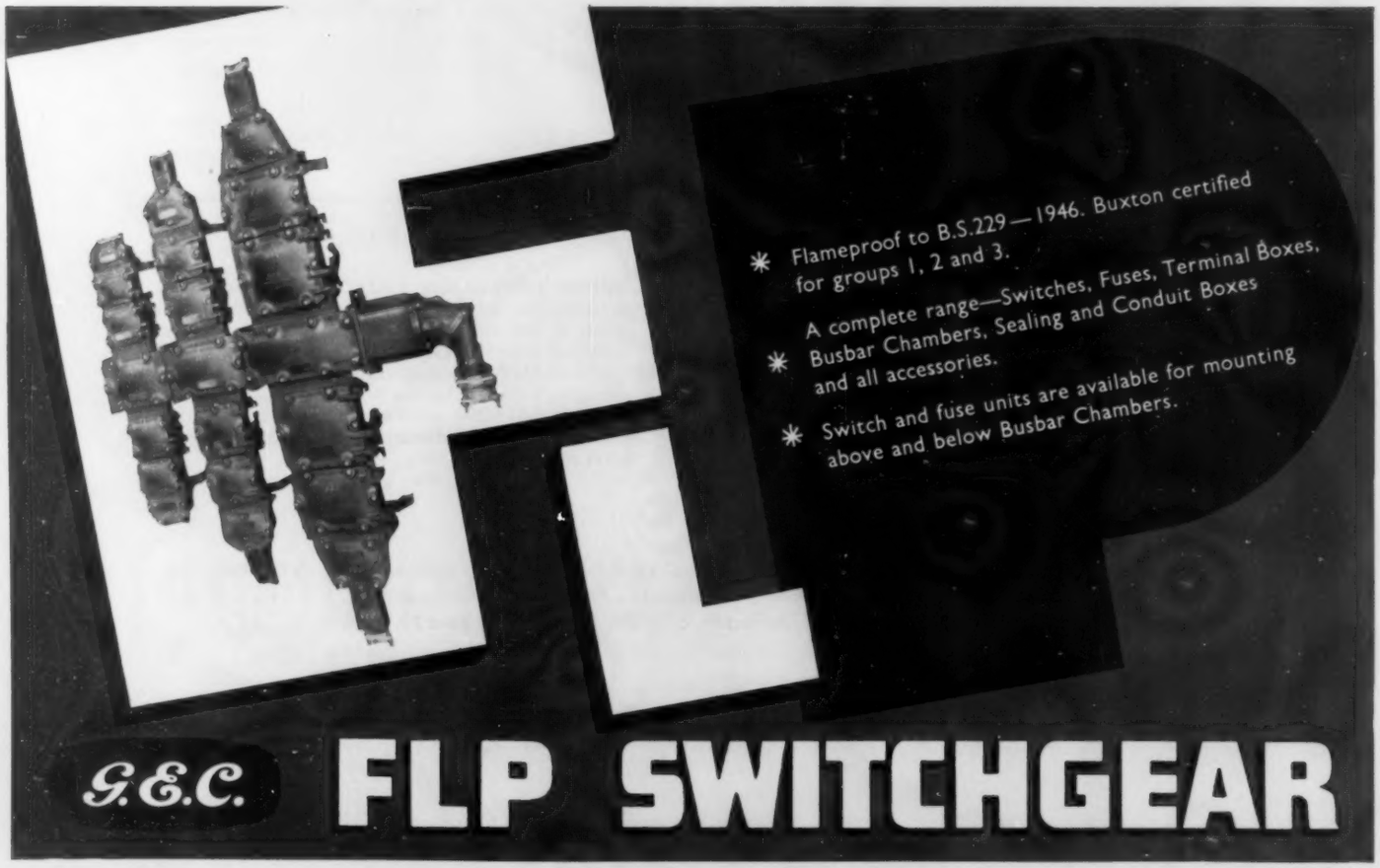
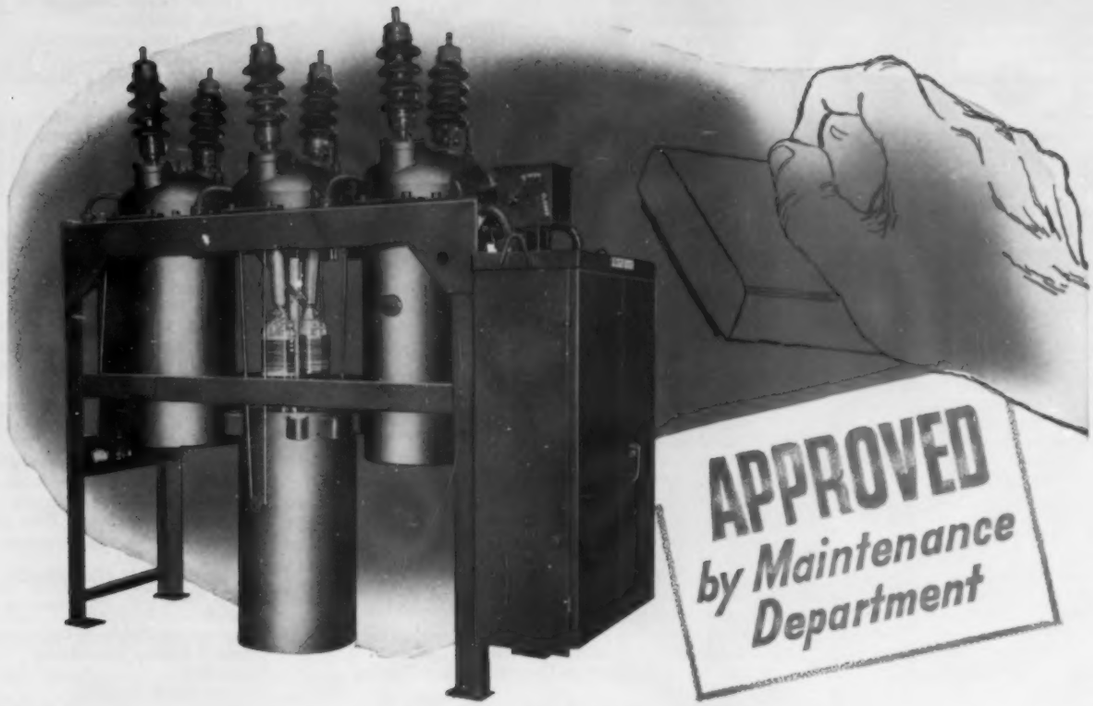
WORKS AT: London, Liverpool, Glasgow, Bristol.


* Flameproof to B.S.229—1946. Buxton certified for groups 1, 2 and 3.
* A complete range—Switches, Fuses, Terminal Boxes, Busbar Chambers, Sealing and Conduit Boxes and all accessories.
* Switch and fuse units are available for mounting above and below Busbar Chambers.
G.E.C.
FLP SWITCHGEAR

THE GENERAL ELECTRIC COMPANY LIMITED · MAGNET HOUSE · KINGSWAY · LONDON · W.C.2



■ Everywhere the new Westinghouse type G frame-mounted oil circuit breaker has been installed, it has received the enthusiastic approval of the maintenance department. Why? Because here is a power breaker designed to put maintenance costs where they belong—at rock bottom.

For example, the pole unit lever assembly has been located *inside* the tank top . . . leaving a smooth, easy-to-clean and easy-to-paint exterior surface. Solder-seal condenser bushings provide high mechanical strength and uniform voltage stress . . . and are manufactured to new ASA standards for ready interchangeability. And Westinghouse-developed De-ion Grid Arc Control helps lower maintenance costs by reducing contact burning and oil deterioration.

Of course, operation has not been overlooked, either. Improved De-ion Grids . . . power factor test taps . . . multi-ratio-type bushing current transformers with *Hipersil* cores—these are just a few of the features.

The new Westinghouse type G breaker is available in ratings from 14.4 to 69 kv. For the full story of how it can serve *you*, please write to me on your company letterhead for a free copy of booklet DBW-33-252.

J. H. Smith, *Supervisor*
Switchgear Section

WATCH WESTINGHOUSE!

WHERE THE FUTURE IS ALREADY IN PRODUCTION

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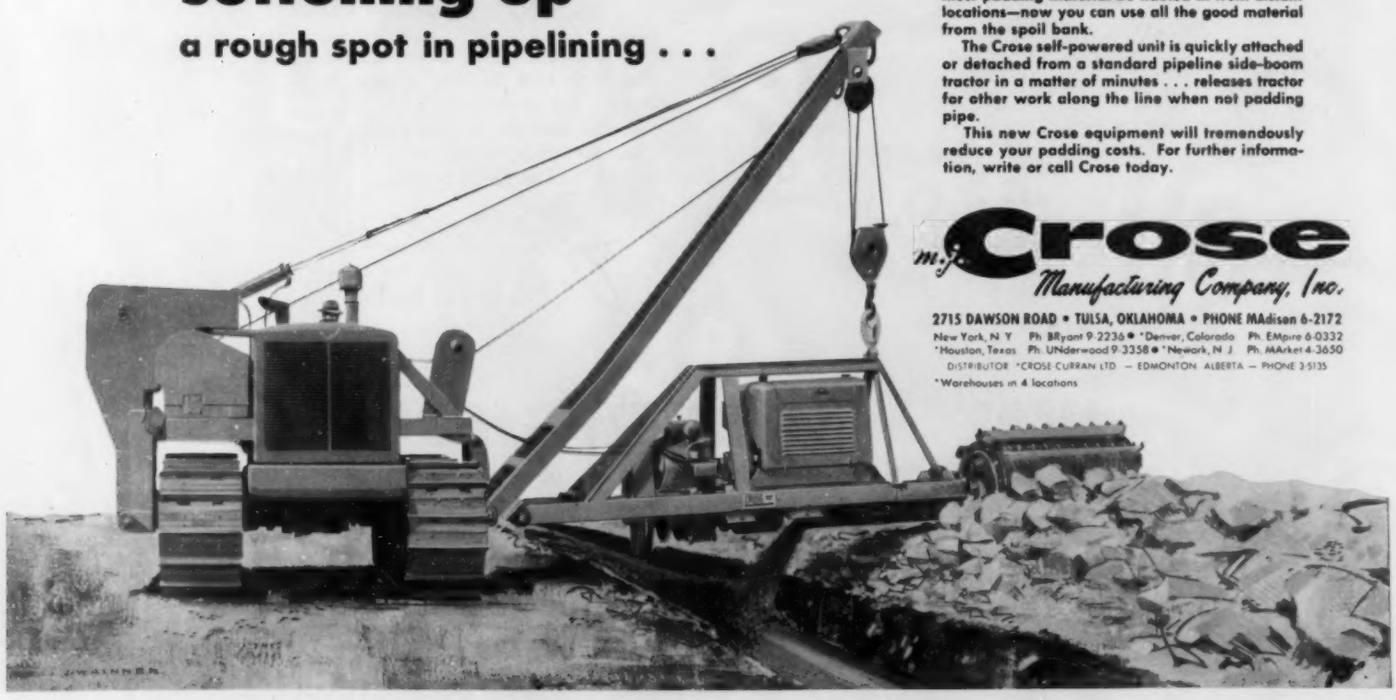
THE NEW CROSE PIPELINE DITCH PADDER

softening up

a rough spot in pipelining . . .



Forward Thinking Crose Engineering has produced another machine to reduce pipeline construction costs! This ditch padder has a screening head and conveyor that completely pads coated pipe with selected soft, rock-free soil. Sharp, pipe-damaging rocks are eliminated. No longer must padding material be hauled in from distant locations—now you can use all the good material from the spoil bank.

The Crose self-powered unit is quickly attached or detached from a standard pipeline side-boom tractor in a matter of minutes . . . releases tractor for other work along the line when not padding pipe.

This new Crose equipment will tremendously reduce your padding costs. For further information, write or call Crose today.

M. J. Crose Manufacturing Company, Inc.

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The Unique Profit Story Behind

OIL WARRANTS

How You Can Prepare for This Year's Similar Opportunities

There are large speculative gains to be made in Oil Stock warrants — often 4 to 5 times those available in ordinary stocks — by investors able to devote a part of their funds for this purpose, and frankly recognizing both the risks and the exceptional profit possibilities involved.

As a typical example, a $1,000 investment in Canadian Oil Cos. Common Stock in September 1953 would have grown to $2,000 by August 1955 — 22 months. *In the same period, however, $1,000 put into the Company's Warrants increased to $11,000, or more than five times the initial cost.*

This is only one out of a long authentic record of similar cases where $1,000 purchases have become worth $8,000, $10,000 and even $19,000 in a relatively short time.

2 STRIKINGLY SIMILAR CHANCES FOR PROFITS IN WARRANTS

We've been searching the oil field over for other potential big-gain warrants like Canadian Oil Cos., and have just uncovered two exceptionally promising new Canadian warrants. One, a little company with big-name backing, gives you 2 special advantages—first, for capital safety a large royalty play with a tremendous built-in growth capacity; second, for powerful capital gains a wildcatting program with truly electrifying discovery possibilities. The other is a smartly-run young LP-Gas Company which is now making "seven-league" growth strides.

The stocks of these two stand-out companies are capable of sharp upward gains. And, if and when the stocks do, the two warrants (both priced under $3.20) could prove to be a profitable investment.

The great gain potentials that we see in these two issues have as yet remained largely undiscovered by investors. As a result, these warrants now give you, we believe, two outstanding ground-floor profit opportunities. Find out about these big profit-potential warrants today. Send immediately for this new Report on:—

"2 CANADIAN OIL WARRANTS WITH BIG PROFIT POTENTIALS"

You also receive 2 additional new Reports entitled:

"THE 'ONE BEST BUY' IN CANADIAN OIL STOCKS" and "27 CANADIAN OIL STOCKS FAVORED BY THE PROFESSIONALS"

This big 3-way Package Report is yours along with a full 5 weeks' trial subscription to the OIL STATISTICS BULLETIN plus the CANADIAN OIL REPORTS for only $5. Return coupon today!

OIL STATISTICS CO., INC.

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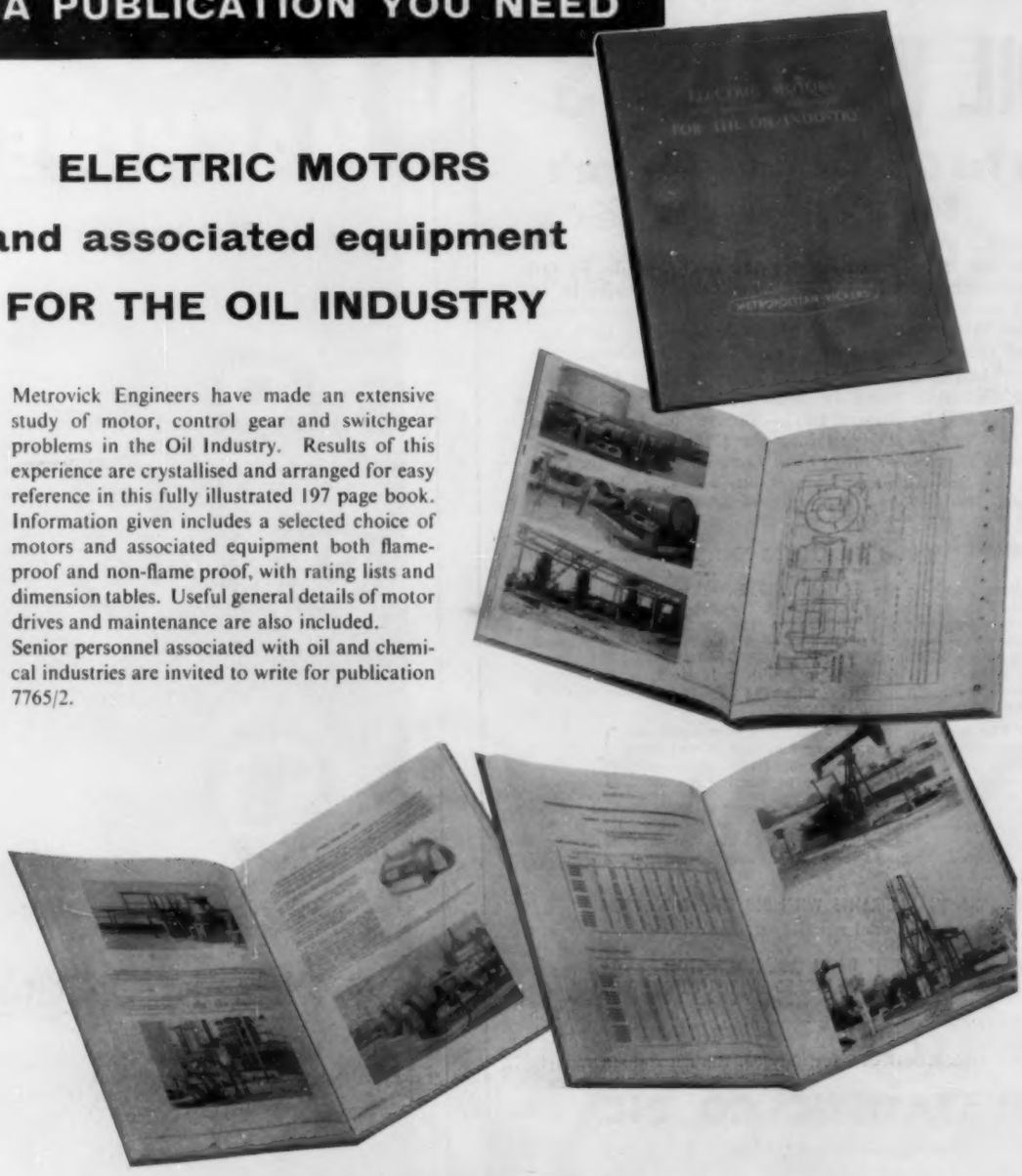
ELECTRIC MOTORS
and associated equipment
FOR THE OIL INDUSTRY



Metrovick Engineers have made an extensive study of motor, control gear and switchgear problems in the Oil Industry. Results of this experience are crystallised and arranged for easy reference in this fully illustrated 197 page book. Information given includes a selected choice of motors and associated equipment both flame-proof and non-flame proof, with rating lists and dimension tables. Useful general details of motor drives and maintenance are also included.
Senior personnel associated with oil and chemical industries are invited to write for publication 7765/2.

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Motors for the Oil Industry

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22,570 FEET - 350°F - Magcobar was there!

A major factor in drilling the world's deepest well was good mud control and good mud. Magcobar furnished approximately 80% of the drilling mud and chemicals on the LL&E No. 1-L Humble, record breaker drilled by Richardson & Bass, John W. Mecom, and Freeport Sulphur.

Here's what the trade papers have to say about the mud program on the world's deepest well:

Oil & Gas Journal, January 23, 1956:

"Good mud control was an important factor in the well's reaching the record depth . . . Static bottom hole temperature was estimated to be more than 350° F . . . Lime treated muds usually cause trouble by solidifying at this temperature, but this mud stayed in good condition all the way . . ."

Petroleum Week, November 18, 1955:

"The planning that went into this well is also evidenced by the careful handling of the mud . . ."

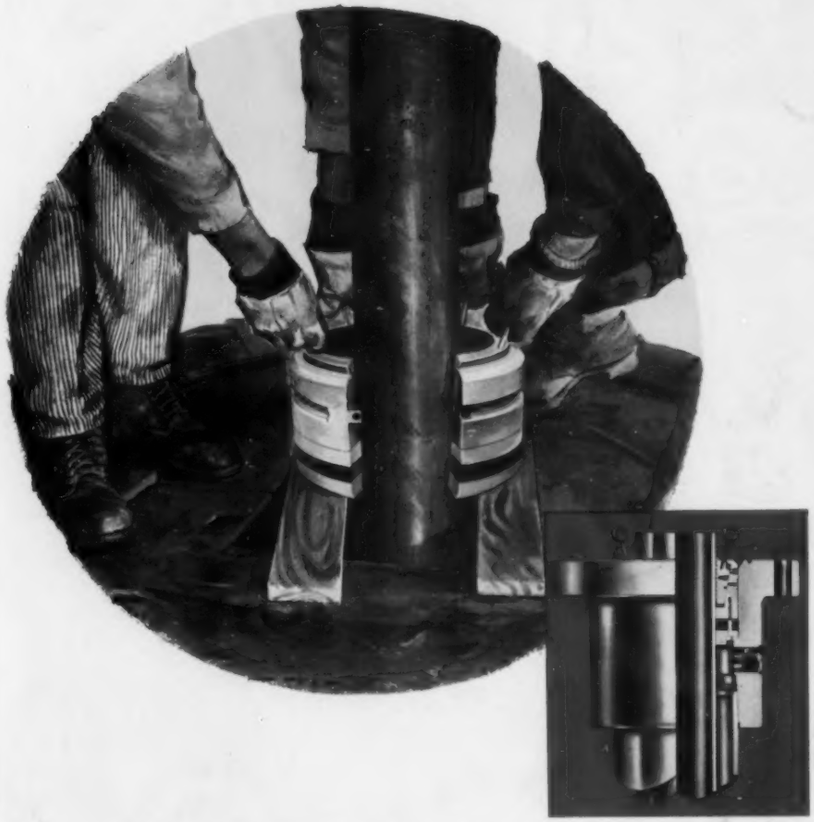
Petroleum Engineer, December, 1955:

"Operators point out that the success achieved can be largely attributed to careful planning and excellent control of the drilling mud . . . Mud control is key to record depth . . . Of considerable interest is the lack of difficulties due to lost circulation, excessive gas cutting and excessive filter cake commonly encountered in South Louisiana. Success in avoiding these difficulties has been attributed to the accurate control of the mud weight and properties."

Magcobar
Complete
DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION
HOUSTON, TEXAS

THE O·C·T C-20 CASING HEAD



lets you work in *Safety*

Regardless of how or when you decide to install the O-C-T "C-20" Casing Hanger . . . before cementing, after cementing, through preventers, under preventers, or at any time in case of stuck pipe . . . you can improve the safety of your completion operations and save hours of expensive rig time due to the flexible, simplified O-C-T installation procedure.

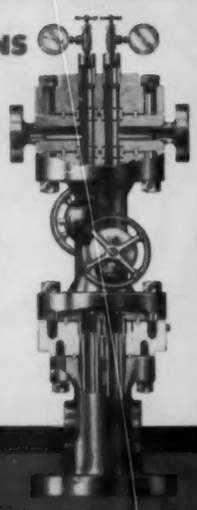
Let your O-C-T Representative give you all the details or write for complete information. Available through more than 700 supply store locations.

The first quick-setting, positive-sealing well head designed especially to eliminate open hole hazards in medium depth wells, the O-C-T "C-20" Casing Hanger can't forget to seal . . . because the sealing element, slip bowl and slips are assembled as a single unit that may be wrapped quickly around the casing, latched and dropped into place, eliminating the possibility of individual parts being installed incorrectly.

FOR DUAL COMPLETIONS
Specify
O·C·T

This compact Oil Center Tool Company Christmas Tree assembly provides a safe, strong and practical means to economical dual completions.

If you are considering dual completions, it will pay you to check the features and get the full story of this O-C-T Dual Completion Assembly.



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OIL CENTER TOOL CO.

P. O. Box 3091, Houston, Texas

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